

Technology Review

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MAY/JUNE 1993

\$3.75

Slowing Down the Quick Fix

A NEW ERA FOR
AMERICAN BUSINESS



ALSO IN THIS ISSUE:

- ◆ SUSAN LOVE ON THE BREAST CANCER EPIDEMIC ◆ GETTING THE LEAD OUT OF MATERIALS PROCESSING ◆
- ◆ THE UNFOLDING PUZZLE OF PROTEIN FOLDING ◆ FULFILLING EDISON'S VISION FOR ELECTRICITY ◆

technology review

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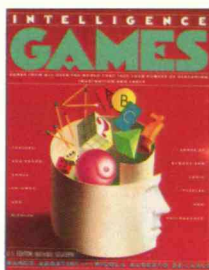
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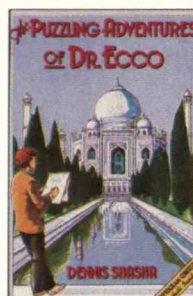


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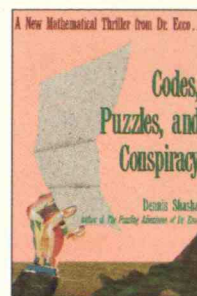
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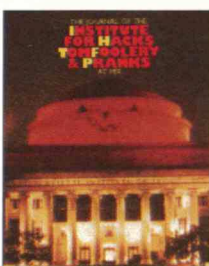


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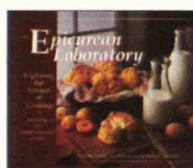


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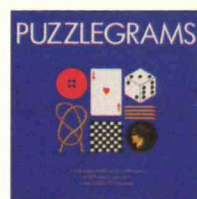


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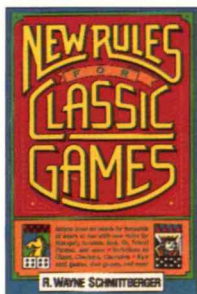


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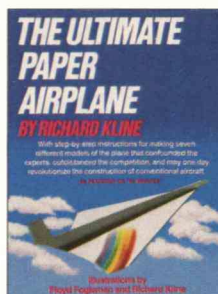


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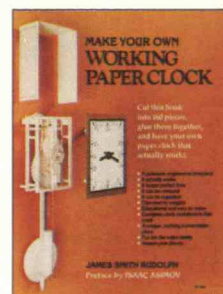


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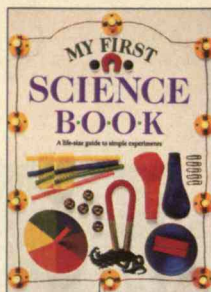


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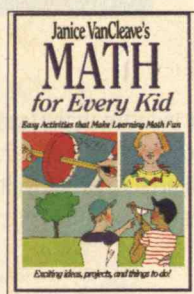
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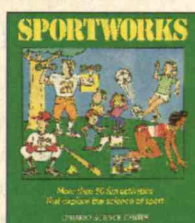
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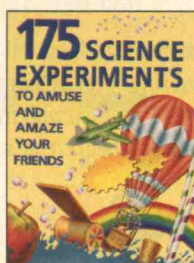
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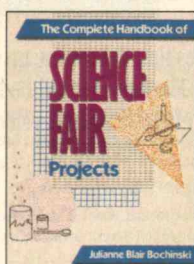


The Complete Handbook of Science Fair Projects

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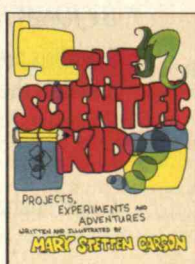


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Photographs by Sing-Si Schwartz

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All ages, Spiral bound, 78 pages, \$13.00



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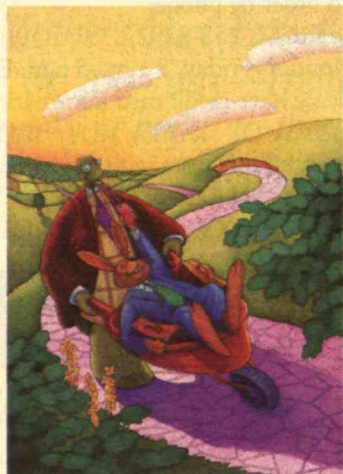
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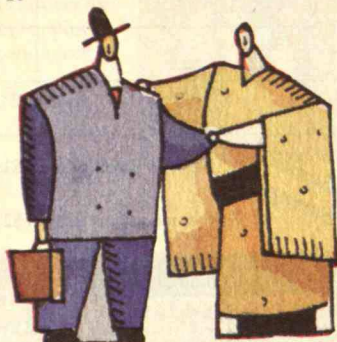
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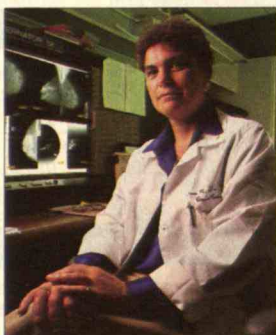
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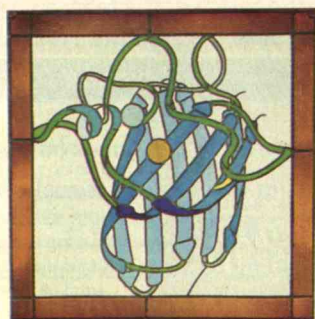
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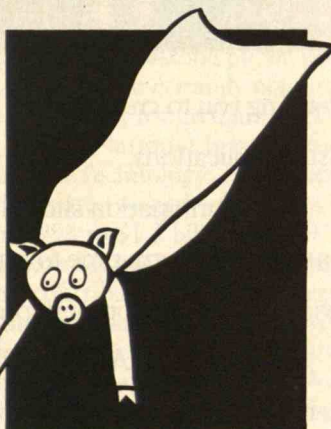
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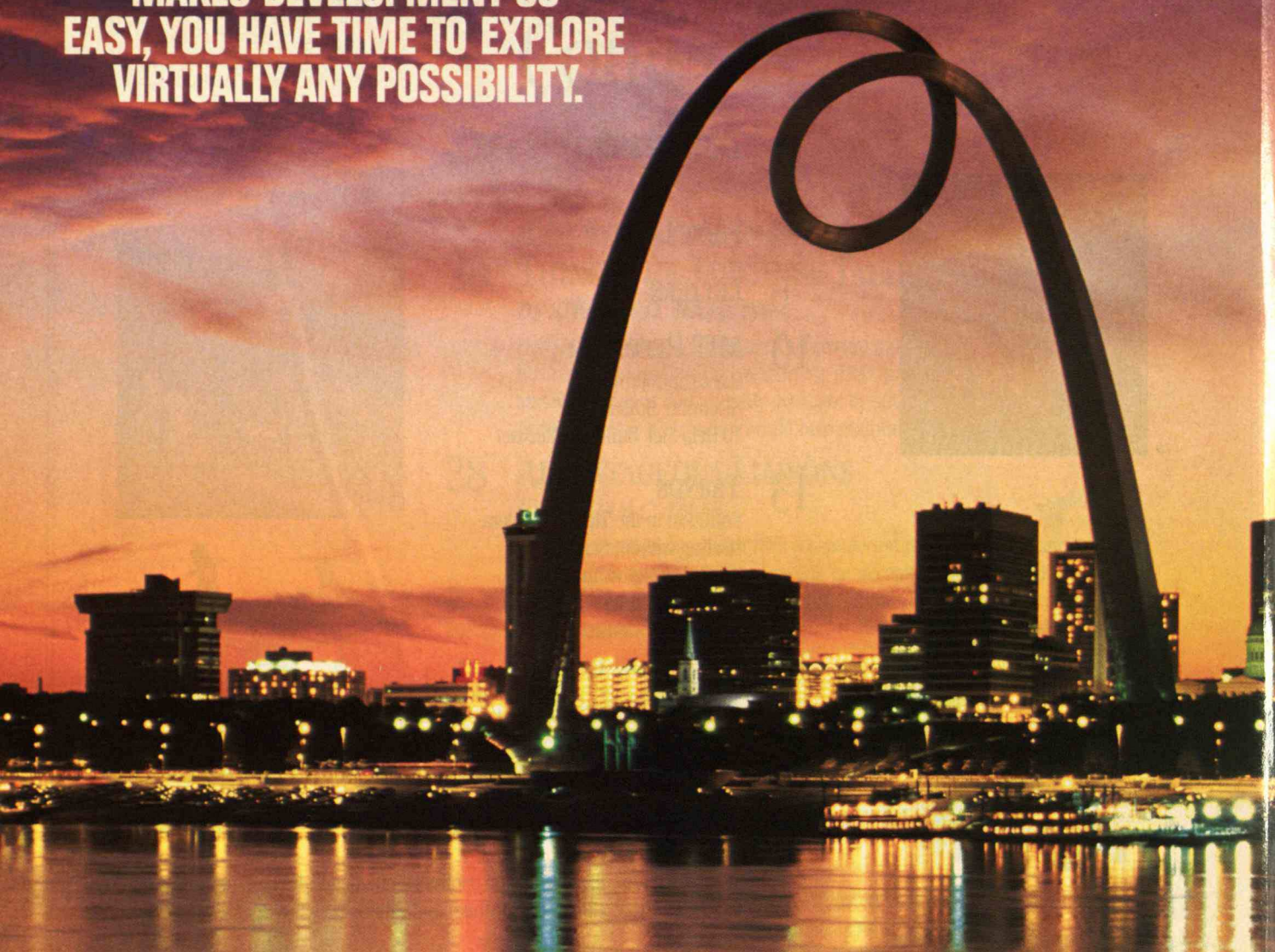
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First Line

A New Spin on Government R&D

LAST year I attended a high-profile meeting sponsored by the National Technology Initiative. Consisting mainly of upbeat presentations and display booths reminiscent of industry trade shows, such meetings were designed to showcase technology already developed by the federal government. Unfortunately, this shot-in-the-dark strategy—throwing money at national laboratories and then hoping that the resulting solutions will somehow match industrial problems—is all too typical of the government's approach to R&D. Such an approach cannot turn around whole business segments in peril from innovative high-tech manufacturers abroad—if it could, many of our major industries would not now be dominated by overseas companies. The “technology push” mode has also become more ineffective as leading-edge technologies have become more complex and must be customized for use in specific industries.

The Clinton-Gore administration says that it wants to move away from business as usual by emphasizing public-private collaborations. It certainly plans to increase the budget for civilian R&D: funding for the National Institute for Standards and Technology (NIST), for example, is slated to grow from \$381 million in 1993 to \$1.2 billion in 1997. But these expenditures will not make an important contribution to revitalizing the private sector unless a “technology pull” strategy aims to match the abilities of government-sponsored technologists with critical needs in key industries early in the research process.

Small moves in this direction are already occurring. The Technology Transfer Act of 1986, for example, encouraged cooperative R&D agreements (or CRADAs) between national labs and the private sector. However, these, too, are often initiated after the government has technology in hand that it

believes has commercial potential. Companies have therefore been hesitant to accept the bald contention that “I’m from the U.S. government and I’m here to help you.”

If the government does get serious about helping solve industry's real needs, it doesn't have to look very far: many are well-documented. For example, the National Center for Advanced Technologies (NCAT), sponsored by the Aerospace Industries Association, has spent several years defining key

*Rather than
funding solutions in search
of problems, the Clinton
administration must team up
technologists with industrialists
right from the start.*

needs in areas such as advanced sensors, ultrareliable electronic systems, and artificial intelligence. The savvy of federally sponsored researchers could go a long way toward helping create these technologies.

Two fledgling ventures may provide useful models for more effective government-industry collaboration. American Technology Initiative (AmTech), a small nonprofit corporation based in Menlo Park, Calif., helps create partnerships between NASA technologists, private industry, and universities. AmTech originated in the late-1980s when NASA was looking to go beyond simple procurement to establish the underpinnings of joint public-private research. AmTech has so far formed three new alliances, including the ACSYNT Institute, which brings together six companies, seven universities, NASA, and the Navy to work on aircraft synthesis and design. Syed Shariq, AmTech's CEO, says the partnerships are not merely add-ons to existing government R&D projects but rather fresh collaborations—as evidenced by the fact that companies must

agree to commercialize the results. To avoid typical stumbling blocks, AmTech has developed a framework for protecting companies' rights to previously invented technology and guidelines for allocating rights to future results.

A second promising initiative is sponsored by the Commerce Department. While Commerce's Advanced Technology Program (ATP) is devoting nearly \$68 million in fiscal 1993 to high-risk research—often projects that private industry won't touch—a small think tank buried within the Technology Administration Office is spending a minute fraction of that amount with potentially greater long-term impact. The group, headed by Lansing Felker, has developed the Strategic Partnerships Initiative (SPI) to organize joint ventures among manufacturers, their suppliers, and users. These “vertical” partnerships are unusual in the United States in that none of the members compete with one another—a fact that encourages them to work on their most important technology-based problems. SPIs are also more comprehensive than the usual private-sector alliances, focusing on everything from R&D through manufacturing and marketing. The SPI concept has been slow to catch on, perhaps because the department provides guidance but not R&D funding, but several agreements are in the works to develop technologies such as aluminum composites and robotics.

While broad results from these ventures may be years away, the U.S. government would do well to apply the innovative thinking that underlies them to other projects. Funds that would otherwise be spent to spin off existing technologies would instead be devoted to connecting government scientists and engineers to significant challenges in the real world. ■

—JERRY WERNER

JERRY WERNER, formerly a senior manager with the Microelectronics and Computer Technology Corp. (MCC), a pioneering consortium, is president of Werner Associates, an Austin-based firm that advises joint R&D ventures.

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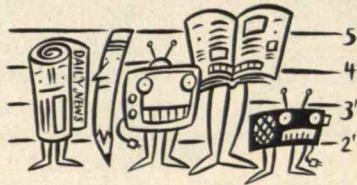
WHY JOURNALISTS SHOULD IMITATE SCIENTISTS

Many thanks for publishing your brave, incisive, and readable panel discussion of the minefield between journalists and scientists ("Confronting the Bad News Bearers," *TR* October 1992). Perhaps one of the most important points the panelists made is that reporters have a hard time selling stories to their cheroot-chewing editors, who are notoriously uninterested in science unless it bears on topics such as hemorrhoids, heart disease, or the effects of heavy drinking. Too often the result of this reporter-editor struggle is an overhyped science story.

Science reporting also suffers from the lack of time to gather facts. After all, writers must cover everything from the birth of a panda at the National Zoo to new theories on the birth of the cosmos. But another reason science reporters fall short in their research may be the fear that too many complications will suffocate their stories. "Never let a fact spoil a good story," they only half-jokingly quip to one another.

One of the panelists, Pulitzer Prize-winner Stuart Diamond, may have slipped into that trap. In an anecdote about his experience covering the Three Mile Island accident, he says that when news broke of a potentially explosive hydrogen bubble, he got a chemist on the phone who claimed the gas couldn't explode. The chemist refused to go on the record until cleared by his company. In the two-and-a-half-day interim, Diamond says, 144,000 people fled their homes.

Why didn't Diamond use that time to call some other experts, preferably disinterested university-affiliated scientists? A lone scientist's calculations should never stand unchallenged. What if the company chemist had gone on record with his prediction and then—whoops!—an exploding reactor had dosed tens of thousands of falsely reassured citizens with radioactivity? Surely a reporter faced with such a possibility should take



extra time to talk to a number of experts.

That's how science itself works, of course. And when representatives of the news media

begin to imitate the style of scientists a bit more—even if it means taking longer to finish stories—then the gap between the two hostile camps will narrow, to the benefit of everyone.

JOHN WILKES

Director of the Science
Communication Program
University of California at Santa Cruz

THE LIMITS OF PARTICIPATIVE MANAGEMENT

Barry and Irving Bluestone's "Workers (and Managers) of the World Unite" (*TR* November/December 1992) is a thoughtful and provocative analysis of problems in labor-management relations. I agree that worker empowerment—by way of employee involvement and autonomous work groups—is an important trend in manufacturing companies. Where properly implemented, it has produced dramatic benefits for employers and employees alike. However, to conclude that all companies should adopt that style of management is premature. And to unreservedly advocate the "enterprise compact"—joint labor-management decision making on all workplace and strategic issues—is a leap of faith I'm not yet prepared to take.

Participative management can and does work well in union and nonunion firms—Corning and Motorola, for example. It's also clear that empowerment through autonomous work teams requires a largely multiskilled work force compensated on a skill-based pay system. Thus manufacturing clearly needs to invest more in worker training.

But the politics and agendas of some unions make adopting participative management considerably more difficult than the authors indicate. Local and national union elections, antiteam groups within unions, and the posturing entailed in collective bargaining can all make it hard for union leadership to

support such an approach. Though the enterprise compact may work in some companies, other management-worker arrangements will be more appropriate in many cases.

JERRY JASINOWSKI
President

National Association of Manufacturers
Washington, D.C.

LEARNING FROM CHINESE MEDICINE

Arielle Emmett is right: here in the United States, the medical establishment certainly does not recognize the validity of Chinese medicine, and much of the problem is rooted in our self-centeredness and general ignorance of other cultures ("Where East Does Not Meet West," *TR* November/December 1992). Most U.S. physicians, researchers, and technocrats somehow assume that traditional Chinese medicine (TCM) must not be very good—even though it's the most extensively documented healing system in the world. TCM, used continuously and effectively for over 2,500 years, currently serves more people than does Western medicine.

The United States may boast the most advanced medical care for acute illness and claim the greatest number of Nobel Prize winners, but Americans are not necessarily healthier than the citizens of China, who rely on both Western medicine and "primitive" TCM and pay far less. It would be economically and scientifically foolish not to take a serious look at Chinese herbal drugs. After all, Western medicine still can't do much to treat the common cold, cancer, diseases of the immune system, and other conditions that affect more than a single body tissue or organ. It is in these areas that Chinese herbal medicine can serve us well—unlike Western medicine, it stresses the importance of a body in harmony.

It is time for us to reassess our health-care goals. Do we want to develop "magic bullet" drugs, or do we have the courage to admit that TCM might offer safe, effective, less costly alternatives?

ALBERT Y. LEUNG
Glen Rock, N.J.

HYPE AND FALSE HOPE

In "Computer-Aided Walking" (*Reporter*, *TR* January 1993), Cathy Olofson writes of a paraplegic woman's headline-making "10-foot walk to a podium to receive her graduation diploma." While Olofson points to the hype and false hopes that resulted, she neglects to mention that the walk itself, supposedly made possible by computer technology, never took place.

It's true that in a *60 Minutes* segment first aired on June 17, 1984, Morley Safer said the woman, Nan Davis, "walked to receive her diploma, directed by computer." The segment inspired a TV docudrama as well as extensive media coverage for Ms. Davis's doctor, Jerrold Petrofsky—including an article in *Discover* and a story on *Nova*. But *60 Minutes* never actually showed Ms. Davis walking unaided. As Safer narrated, the camera zoomed in on her straining face. What the audience could not see was the men at her sides who were supporting her.

Did *60 Minutes* know that Nan Davis was supported? Yes, according to producer Joe Wershba. "There's no doubt she was supported," he told me. But, he argued, "Dr. Petrofsky is a magnificent symbol of man's unquenchable desire to stay alive. That's the message we tried to get across."

The quackery and flackery surrounding this "magnificent symbol" does not invalidate the possibility of using computer technology to help paraplegics. However, those who encouraged false hope were cruel. (In rebroadcasts of that *60 Minutes* segment, by the way, Safer's narration was changed, and the claim that the walk was unaided was deleted.)

FRED JEROME
Executive Vice-President
Scientists' Institute for Public Information
New York, N.Y.



INEXORABLE PROGRESS IN SPORTS TECHNOLOGY

David J. Bjerklie need not fear that innovative sports equipment will make athletic competition unfair ("*High-Tech Olympians*," *TR* January 1993). Technological improvement has always been a way of life in sports. What if Bjerklie were transported to the latter part of the last century—how would he react to the idea of gloves for baseball players? Back then it was generally believed that anyone who wore a padded glove was a sissy. Today gloves are in vogue throughout baseball (except, of course, for designated hitters and, arguably, the Dodger infield).

Scarcely anyone remembers a time when football players galloped around bareheaded, but some readers may recall a famous comment by Lyndon B. Johnson on the subject. While a congressman, he remarked that a colleague who'd been a college All-American had "played football too many times without a helmet." Certainly the advent of headgear has been a blessing for football players, even if it has done nothing to improve Capitol Hill.

As in every other endeavor, progress in sports is inexorable. With technologically improved equipment available to all, it's still the best man—or woman—who triumphs.

FRANK GREENBERG
President
The Athletics Congress of the USA
Indianapolis, Ind.

HOW DESIGNS REALLY EVOLVE

In "How Designs Evolve" (*TR* January 1993), Henry Petroski tells a nice rational story about how products undergo "successive correction" with "new, improved versions coming in all shapes and sizes." He illustrates his point by examining tools with a long history and a leisurely development cycle: axes, paper clips, hammers, saws, tableware.

But unfortunately, his argument doesn't hold in the modern high-tech marketplace. Today industry is much more concerned with "time to market" and "return on investment" than with elegance, utility, and the slow, progres-

sive evolution of a product. Design is all too often driven by a desire to change for the sake of change—to give the advertising agencies something to talk about. What matters is how well a product can be distinguished from the competition while also having the very same features—a self-contradictory goal.

Look at the automobile industry. Each year new models boast some well-advertised advantage, but these changes are hardly dictated by the quest to make things function better. Want another example? Take computer software, whose purveyors rely on the routine upgrade. Software companies expect you to commit to a way of life. Once you have purchased a word processor, spreadsheet, or drawing package, you are subject to a continual barrage of improvements, help lines, and newsletters.

The problem is abetted by the specialty magazines that evaluate products such as automobiles and computer software—they compare feature with feature, and measure speed and performance in tests that have absolutely no relationship to the conditions under which the products will actually be used. Manufacturers soon learn, however, that they had better design for good magazine reviews.

Petroski's way is the correct way: products should reflect the way people use them. Engineers ought to use their own products (a surprisingly rare event) and watch real users (even more rare). No wonder so many customers cry out against technology. In fact, it is not technology itself that bothers them but the lack of a person-centered design philosophy.

DONALD NORMAN
Apple Fellow
Apple Computer
Cupertino, Calif.

The writer is a former chair of the Department of Cognitive Science at the University of California, San Diego.

Henry Petroski mentions the center of percussion (CP)—the point on a hand-held stick that will deliver the maximum blow without hurting the hand. But he talks about the CP only in relation to the axe, although this concept has influenced the design of many other objects as well.

In baseball, for example, the bat should deliver the greatest possible blow to the ball: the CP should be the point of impact. In golf, the purpose of the club called the driver is likewise to hit the ball with the largest achievable force, and thus the compact club-head houses the CP. As with the axe, the CP of the bat and the driver is located as close as possible to the working edge of the tool.

RICHARD S. HARTENBERG
Professor Emeritus of
Mechanical Engineering
Northwestern University

DOUBTS ABOUT GLOBAL WARMING

Giles Novak comments that environmentalists are concerned about carbon dioxide because it "accounts for 75 percent of humanity's contribution to the greenhouse effect" (*Letters, TR January 1993*). But the amount of CO₂ that humans are responsible for must be compared with the total amounts of the gas already in the atmosphere.

Human activities produce some 6 to 7 billion metric tons of CO₂ annually, while the atmospheric envelope contains about 750 billion metric tons of naturally occurring CO₂, all of it in dynamic equilibrium with about 37,000 billion metric tons of inorganic carbon dissolved in the oceans. Moreover, scientists estimate that emissions of naturally occurring CO₂ are more than 200 billion metric tons a year.

Many investigators are beginning to share doubts that the trend in atmospheric gases means a growing threat of global warming. According to the *Bulletin of the American Meteorological Society*, "there are now several compelling lines of evidence that indicate the chance of an ecologically or economically disastrous global warming is becoming more remote."

ALAN W. KATZENSTEIN
Larchmont, N.Y.

CORRECTION

According to "Radiation Risks Revisited" (*TR February/March 1993*), studies of Japanese atomic-bomb victims concluded that myeloid leukemia, a bone-marrow cancer, was the only cancer that resulted from radiation exposure. Actually, the studies also showed increased rates of epithelial cancers, such as those of the thyroid and lung. But Alice Stewart, the British epidemiologist whose work was described in the piece, maintains that overall, myeloid leukemia was the cancer whose rise was most dramatic—especially in the first 15 years after the bombings.

TechnologyReview

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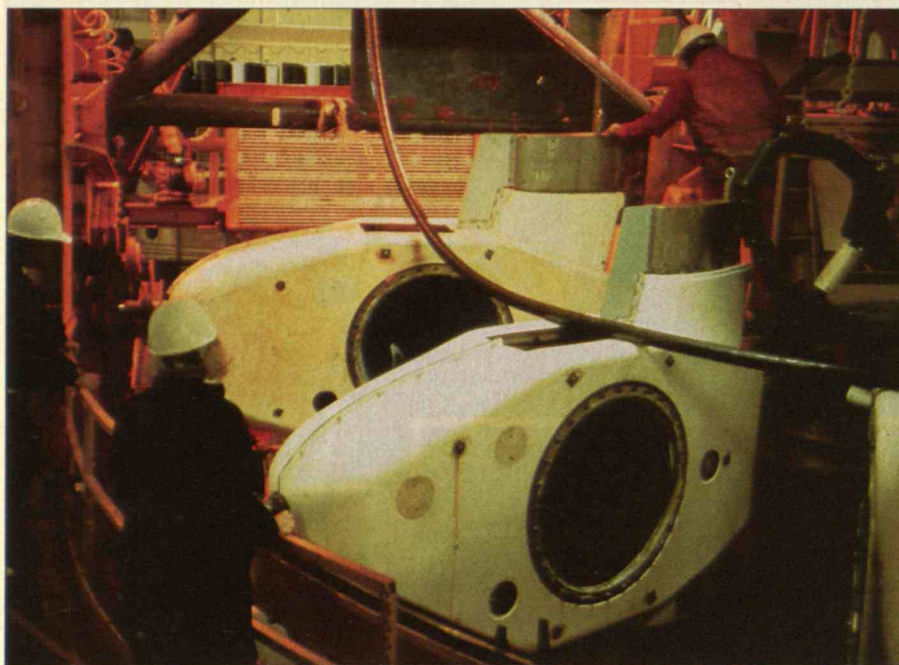
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MIT Reporter



OCEAN SOUNDINGS

 The humming, low-pitched, undulating sound—turned loose underwater near obscure Heard Island in the Indian Ocean—came through loud and clear on both coasts of the United States, half a world away.

Pumped out by huge loudspeakers hanging in the water about 300 meters beneath the research ship *Cory Chouet*, the 1991 test confirmed that noise moving through thousands of miles of water can be used as a temperature gauge. Because the velocity of sound in seawater rises 4.6 miles per second for each 1° Celsius increase in temperature, repeated measurements of acoustic travel time could help researchers detect changes in the ocean's heat content.

Measuring ocean temperature is important "to understand and predict global warming," explain Arthur B. Baggeroer, Ford professor of engineering in MIT's Department of Ocean Engineering, and Walter Munk, of the Scripps Institution of Oceanography in La Jolla, Calif., in a recent *Physics Today* article. "The oceans play a vital role in global temperature changes, storing both heat and greenhouse gases."



Loudspeakers driven by hydraulic pumps (top) were suspended from the Cory Chouet to produce pulses of noise picked up several hours later halfway around the globe.

Oceanic warming as slight as a few thousandths of a degree would shorten acoustic travel time several tenths of a second across very long distances, according to Robert Spindel, who also worked on the project as director of the Applied Physics Laboratory at the University of Washington. "That large a change is an easily measured number."

John Spiesberger, an oceanographer at the Woods Hole Oceanographic Insti-

tution, says the research shows that this technique can accomplish what more conventional measurements of worldwide seawater temperature can't: "There aren't enough oceanographers in the world to simultaneously dangle thermometers over the sides of ships." And even if such a method were practical, sorting out what the ocean is doing as a whole would be difficult because of local variations in currents, evaporation rates, tides, and surface winds.

Precise Pulses

To produce the noise, the researchers suspended 10 drumlike metal vessels, each about five feet across, from the ship's center well. Internal hydraulic pumps flexed the drum faces to create precisely timed pulses of noise. The sounds reached hydrophones—fist-sized underwater microphones—stationed on both U.S. coasts and in Bermuda some 3.5 hours later. Other hydrophones had been placed at numerous sites off both U.S. coasts and at other locations around the globe.

The project was delayed for two years because the U.S. Marine Mammal Protection Agency, and subsequently Greenpeace and other environmental groups, had concerns about whether the 220-decibel signals—a volume equivalent to that of a screaming jet engine—could harm ocean animals. The scientists finally received test approval after agreeing to help set up a simultaneous marine mammal research program.

Marine mammal surveys near Heard Island did not reveal major changes in behavior during the test, according to bio-acoustician Ann Bowles of the Hubbs Sea World Research Institute in San Diego. Although the animals seemed quieter, they apparently did not leave the area.

Baggeroer and his colleagues are now putting together an international research team to work toward creating a worldwide, undersea sound system for detecting temperature changes.

—ROBERT COOKE (*The author is a science reporter at Newsday.*)

ELECTRONIC BUTLERS

 Within the last few years the "desktop" metaphor for operating systems, with icons and "windows," has virtually taken over the computer world, helping users of machines from workstations to personal computers. But just as desktop systems are achieving dominance, computer pioneer Alan Kay is predicting their imminent demise.

Replacing that mode will be a concept that relies on "agents" now being developed by, among others, Patricia Maes, assistant professor at MIT's Media Lab.

Instead of a desktop system that passively awaits a user's instructions, an agent-based system tries to anticipate his or her most likely actions. After some experience with a user, agents learn to automatically perform routine tasks. For less predictable tasks, agents ask their "masters" what they desire before carrying out a function. Media Lab director Nicholas Negroponte has compared agents to good English butlers.

One agent unfolding in Maes's lab is designed to help deal with electronic mail, which is increasingly overloading people in academia and business. The agent can learn to sort mail according to priority. For instance, a message from the user's boss might sound an alarm signaling him

or her to read the note immediately, while a routine request for information could be filed away for later viewing. E-mail agents could even figure out how to answer common re-

quests. In response to a memo calling for, say, the past month's sales figures, an authorized agent could automatically retrieve the figures from the user's hard disk and forward them to the

colleague who wants them. The agent would log its action in a file that could be checked later.

Another Maes device helps people schedule appointments: this agent negotiates electronically with similar agents elsewhere, setting up the time and place for a meeting and sending out invitations.

The agent system works by building up a "memory"—or database—of different situations and the user's response to them, Maes explains. The agent looks through the database for actions that most closely match a new scenario, then carries out the task.

As Maes's agents work, they employ graphic symbols—drawings of faces whose expressions convey activity at a given moment, such as thinking, offering a suggestion, and looking pleased if a suggestion is followed. This provides the user with feedback on an agent's activities.

In the future, agents should be able to take over more complex functions. For example, Maes and other researchers are trying to create agents that can scan newspapers, magazines, books, and elec-

tronic databases for material that fits a user's general interests or satisfies specific requests. Such systems will have to be smart enough to recognize that if someone wants to know about gardening, an article on horticulture is relevant even if it doesn't mention the word "garden." That kind of common sense will require a massive database of knowledge and rules. The most ambitious such effort is now under development by the Microelectronic and Computer Technology Corp. in Austin. The earliest versions of this database may appear as part of some software products within a year or two.

As Maes works to improve the ability of these information-seeking agents, she occasionally pits different models against one another. Those that perform

the least satisfactorily "are allowed to retire," she says.

During the next decade, Kay and other industry observers think, computers using agents will also have speech synthesizers and devices that can make sense of everyday language, be it spoken, keyed onto touch-sensitive screens, or written with a stylus. At that point agent-driven computers will, some suggest, be on the way toward acting like the humanlike computers of *Star Trek* and 2001.

The notion of the computer as a desktop controlled by a user was "destined to die," says Kay, who was part of the group that developed that concept at the Xerox Palo Alto Research Center in the 1960s. In its place, he says, agents "will wind up being able to do almost everything."—DAVID CHANDLER (The author is a science reporter at the Boston Globe.)

Friendly computer agents designed by Patricia Maes, MIT assistant professor of media arts and sciences, employ graphic symbols to convey different activities and responses.

Unsure



Pleased



Confused



Working



Alert



Thinking

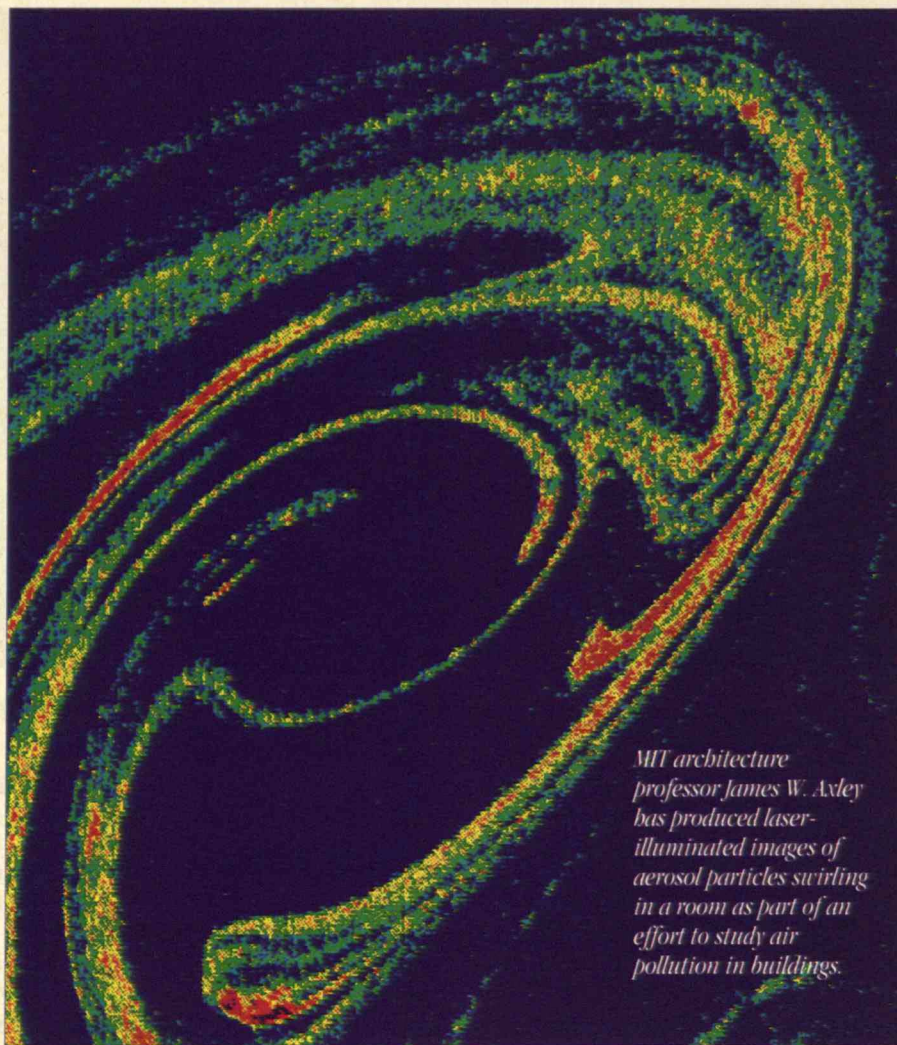


Surprised




Gratified





MIT architecture professor James W. Axley has produced laser-illuminated images of aerosol particles swirling in a room as part of an effort to study air pollution in buildings.

TO HELP SICK BUILDINGS RECOVER

 Headaches, nausea, tension, or simply unexplained fatigue: these are the complaints that thousands of working Americans blame on the buildings in which they are employed. The workers are the victims—real or imagined—of “sick building syndrome,” a poorly understood problem estimated by the Environmental Protection Agency to cost the nation \$60 billion a year in absenteeism and reduced productivity.

There are no evident physiological or psychological causes for SBS. Most experts, including James W. Axley of

MIT's Department of Architecture, blame building-related pollutants—organic solvents emitted by structural materials and finishes such as fireproofing, insulation, adhesives, caulks, paints, and carpets; or byproducts of the human occupants—carbon dioxide, tobacco smoke, and vapors from hair-sprays, deodorants, perfumes, and food. Experts believe that SBS, whose incidence is rising, has been exacerbated by efforts to make buildings “tighter” and thus more energy-efficient.

Today's responses to SBS symptoms are sometimes draconian. When workers in the county courthouse in Stuart, Fla., complained of headaches and other

allergy-like symptoms last year, officials ordered a top-to-bottom, \$34,000 professional cleaning for the building, including disinfectant for the heating/cooling system.

Fresh Solutions

Such a massive response is at best inefficient and often unsuccessful, says Axley. He points to more sophisticated alternatives for large buildings, such as carbon-dioxide detectors that can automatically control the speed of ventilating fans according to the percentage of carbon dioxide in the air. Work stations can be equipped with individual fresh-air outlets to be opened or closed as needed, much like those on commercial aircraft. And in warehouses and lofts, engineers can arrange ducts and fans to deliver fresh air only to those sites where workers are assigned.

But strategies such as these are still seat-of-the-pants, says Axley, because architects and engineers have yet to understand how pollutants behave in built environments; and at low concentrations—usually a few parts per million or billion of ambient air—the culprits are hard to track.

So Axley and his students are seeking new ways to understand how pollutants circulate in buildings. This is a challenging assignment, since natural convection (warm air slowly rising through corridors and stairwells while cold air drifts downward) and forced ventilation, sometimes intermittent, combine to circulate the watery “soup” of unidentified airborne irritants.

To be able to predict, before the construction of a building, turbulent and other kinds of flows, Axley and his students are first studying air flows through models that simulate typical building interiors. Laser-based photography reveals the movements of particles suspended in air—theatrical fog generators are the best sources of the raw material, Axley says—and the results are accumulating in a computer databank.

—JOHN MATTILL (*The author is editor emeritus of Technology Review.*)

Trends

Pollution in the Time of Cholera

After continually devastating populations in every hemisphere, cholera—a disease manifested by severe diarrhea and dehydration—was all but eradicated in the West a century ago through improved sanitation systems. Now, however, cholera is resurfacing with a vengeance. Since 1991, unexpectedly virulent epidemics in Central and South America have killed more than 6,000 people, raising new and disturbing questions about how the disease is transmitted and the most appropriate methods of prevention and control.

Orthodox medical theory holds that cholera is carried only by humans—or, more properly, a strain of bacteria inhabiting the human digestive tract—and spread through fecal contamination of food and water. But recent studies show that cholera bacteria bred in polluted environmental reservoirs—sea coasts, bays, and brackish waters—may better explain cholera's baffling seasonality and virulence.

"The medical community contends that cholera is readily transmitted through infected human feces—and we have no argument with that," says microbiologist Rita Colwell, a leading cholera expert and president of the Maryland Biotechnology Institute, an environmental microbiology research center. But she contends that cholera is also carried by certain species of plankton and algae.

Linking Cholera and Pollution

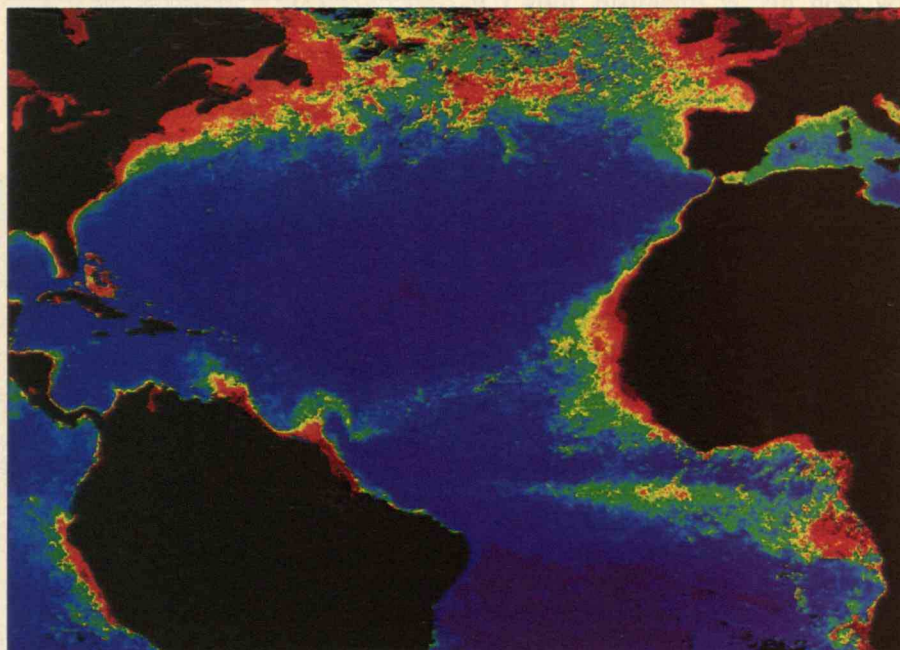
To support the theory, Colwell points to reservoirs she has found in the coastal waters off Peru—the initial site of the recent Latin American epidemic—as well as in the Chesapeake Bay, the waters near Bangladesh, and the Antarctica Sea, where cholera bacteria survive completely free of fecal contamination. "The bacteria attach themselves to plankton and algae and go dormant under hostile conditions," Colwell says.

They then reemerge when conditions are favorable for growth—namely when waters warm and pollution provides added nutrient supplies—and work their way into the human water and food chain, she says.

"What we're putting into the ocean, air, and water is definitely affecting the spread of infectious disease," observes Paul Epstein, a tropical medicine specialist at Harvard University's School of Public Health. "When cholera-carrying

in plankton and algae—standard culturing methods were unable to detect cholera bacteria in marine life. Just two years ago, for example, Colwell found cholera bacteria in water samples in Guayaquil, Ecuador, that had not shown up in standard lab cultures.

Paul Blake, chief of the Enteric Disease Branch at the Centers for Disease Control, holds that while plankton blooms may very well be associated with cholera, the biggest problem remains the

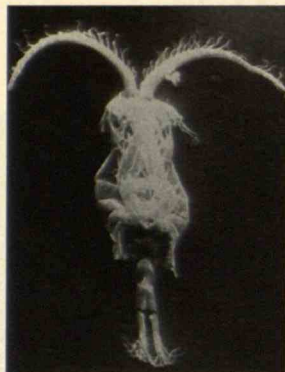


plankton and algae absorb pollutants such as nitrogen and phosphorous, they bloom in unusually large numbers, he says. Researchers at the Adolfo Lutz Institute in São Paulo, Brazil, and the National Center for Infectious Diseases in Atlanta have also demonstrated that cholera bacteria found in waters off the coast of Peru flourish on sewage, industrial pollutants, and fertilizer runoff.

Despite the evidence, "the majority of the medical community believes that cholera reservoirs are caused only by human fecal contamination," Colwell says. One reason for the misconception is that until the introduction of sophisticated detection techniques—among them a test that identifies cholera genes

Cholera bacteria that normally lie dormant in ocean plankton (shown in red) have been found to flourish during the summer in polluted tropical waters. Researchers worry that global warming and additional pollution may lead to more widespread cholera outbreaks.

incredible fecal contamination of our environment. "Feces are the fastest and most effective cause for the spread of cholera," Blake argues. He points to the fact that a human infected with cholera produces the bacteria in astronomical numbers—100 million organisms per milliliter of stool—and may discharge as much as 10 liters of stool per day into water systems that leave 95 percent of



Minute crustaceans called "copepods," which serve as living plankton hosts for cholera bacteria, bloom in large numbers after absorbing pollutants such as nitrogen and phosphorus.

the sewage untreated. These concentrations can be several orders of magnitude higher than those found in plankton and algae.

Blake therefore suggests the goal should be to find ways to separate human sewage systems from drinking water. He points to efforts by the Pan American Health Organization to allocate \$200 million to improve water supplies and sewage treatment over the long term. "We are working on much cheaper and more immediate interventions," he says, "such as the development of special water containers that can store sanitary water in homes without refrigeration."

Colwell counters that such measures, while essential, won't be completely effective because "invisible" cholera carriers are ubiquitous in water supplies during certain seasons of the year. She suggests that in certain regions of the world where boiling water is impossible because of the lack of firewood, crude screening of water through gauze could trap out cholera-carrying plankton as it does larger parasites.

"The bottom line is that even when an epidemic is controlled and infectious bacteria are eliminated from drinking supplies, cholera still lies dormant in the environment. And it may be a growing threat if atmospheric and ocean pollution continues to mount," she says. "You can't get rid of cholera unless you can remove all the plankton from the sea."

—ARIELLE EMMETT

Healing without Scars

Anyone who has ever had major surgery or suffered a deep cut carries a lifetime reminder of the event—a trail of scar tissue covering the old wound. But such is not the case for children who undergo fetal surgery to correct abnormalities before birth. "We couldn't find even a trace of the incisions," says pediatric surgeon N. Scott Adzick, a member of the Fetal Treatment Program at the University of California at San Francisco.

This unexpected outcome has triggered a wave of research into mimicking fetal conditions so that serious burns, surgical incisions, and accidental cuts will heal without scars. This work may also point the way to new treatments for diseases like cirrhosis of the liver or certain types of kidney and heart failure, which are due to wound healing run amok.

Frenzied Response

In children and adults, a cut or scrape kicks off a wild ballet involving scores of proteins and cell types. More than a dozen proteins that circulate in the bloodstream rapidly form a fibrous clot that seals off damaged blood vessels and keeps out dirt and bacteria. Chemical signals attract white blood cells that gobble up foreign microbes and damaged tissue. Other cells that secrete collagen follow the same chemical trail to the wound and lay down a strong but haphazard layer of the protein, thus creating the telltale scarring.

In evolutionary terms, this response makes perfect sense. The faster a wound is sealed and healed, the less likely it will pick up deadly bacteria, fungi, or viruses. "Scar formation just isn't a big deal when you balance it against the worse outcome of dying from infection," says Mark Ferguson, professor of cell and structural biology at the University of Manchester in England.

In fetuses, however, the process is less frenetic. In fact, the wound response resembles tissue regeneration more than tissue repair. At first, Adzick and his colleagues thought the warm, wet, sterile, and nutrient-rich fetal environment was solely responsible for the phenomenon. But when they transplanted patches of newly wounded skin from adult sheep onto the backs of fetal lambs, they found that the lambs were born with scarred squares of skin.

The vital difference, they discovered, was in the type and amounts of wound-healing growth factors at the incision site. A fetal wound sends out



fewer chemical distress signals and thus induces a slower, steadier repair process. New collagen has a chance to form in a highly organized manner that blends perfectly with the surrounding tissue.

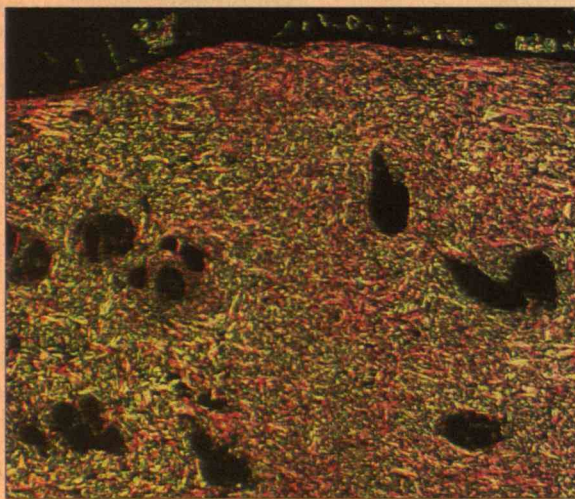
At the University of California at San Francisco and a handful of laboratories in the United States and Europe, researchers are attempting to mimic fetal wound healing by inhibiting a crucial molecule called transforming growth factor-beta (TGF-beta). This protein, released by cells in the vicinity of a wound, stimulates the frantic wound-healing process, drawing the appropriate

cells to the site and prodding them to churn out collagen and factors that stimulate cells to grow and divide. It even directs surrounding cells to make more TGF-beta, further accelerating the response.

Ferguson's team is experimenting with two substances that reduce the amount of TGF-beta in new wounds, making them similar to fetal wounds. One is a mouse-grown antibody that homes in on the growth factor and completely engulfs it. The other is a simple sugar that attaches to the molecule and slightly changes its shape. Both keep TGF-beta from snugly fitting into recep-

prevent a number of potentially deadly disorders such as cirrhosis of the liver, cardiac-muscle scarring, which often follows a heart attack, and a kidney disease called glomerulonephritis, which abnormally switches on the wound-healing process and clogs tiny filters in the kidney called glomeruli with collagen. Kidney specialist Wayne Border and his associates have shown that a particular protein that binds to collagen can also bind to TGF-beta to muffle its activity and reverse the accumulation of abnormal collagen-rich scar tissue in the kidneys of rats with glomerulonephritis. He also expects to begin human clinical tri-

Magnified cross section of an untreated rat skin wound (left) reveals the abnormal organization of collagen scar tissue (shown in red). When injected with a special compound, an identical cut (right) heals with an orderly collagen pattern, making scar-ring undetectable.



tors on the surface of white blood cells and tissue cells, thus slowing the tempo of wound healing and allowing injured tissue to repair itself in a more organized fashion.

Just as important, the new tissue proves to be as strong as traditional scar tissue in recent trials with rats. Human trials using these compounds to invisibly heal simple skin wounds such as those left by stitches or tattoo removal should be under way this year in the United Kingdom, says Ferguson.

Experiments at the University of Utah School of Medicine also suggest that eliminating TGF-beta could reverse or

als later this year.

As promising as these scarless healing techniques appear, inactivating TGF-beta may pose some problems. For instance, besides accelerating wound healing, TGF-beta also plays a role in the immune system and in promoting blood vessel growth. The researchers therefore must determine whether shutting down the growth factor, even for a short period, will affect these functions. They must also find out if introducing the TGF-beta-blocking proteins will provoke the body to develop antibodies that would render the substances ineffective.—P.J. SKERRETT

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Nurturing Native Tongues

It is not on any bestseller list, but a recent Mexican book represents a special kind of publishing landmark. The non-fiction work, *Everyday Life in Jicayan* by Josefa Gonzalez Ventura, is the first to have been written and published in Coastal Mixtec—an endangered native language spoken by a dwindling number of Mexican Indians.

The book is also the first to be published under the imprimatur of a little-known nonprofit institution called CELIAC, based in the city of Oaxaca, Mexico. CELIAC, which translates roughly as the Editorial Center for Indigenous Languages, is a government-funded effort that grew from the work by H. Russell Bernard, an anthropologist at the University of Florida in Gainesville who has been using desktop computer technology to help native peoples develop written records of their languages.

Bernard takes particular advantage of word-processing software that allows writers to reconfigure a standard keyboard to produce special characters. He has found simple ways to represent even tonal languages that rely heavily on inflection to differentiate meaning. Bernard also uses programs to alphabetize words and show them in context, thus simplifying the process of building a dictionary, which is vital to anyone wishing to learn a language or translate a text. In the past, linguists have often taken a decade to create a native-language dictionary.

Bernard's approach—which has thus far enabled 80 people to become authors

in 12 endangered native languages of Mexico and South America—is a dramatic contrast to that of many anthropologists and missionaries. "To keep a language truly alive we must produce authors," Bernard asserts. "Teaching people to read primers and Bibles in a native language does not do this."

Bernard believes serious efforts are needed to stem the staggering loss of lan-

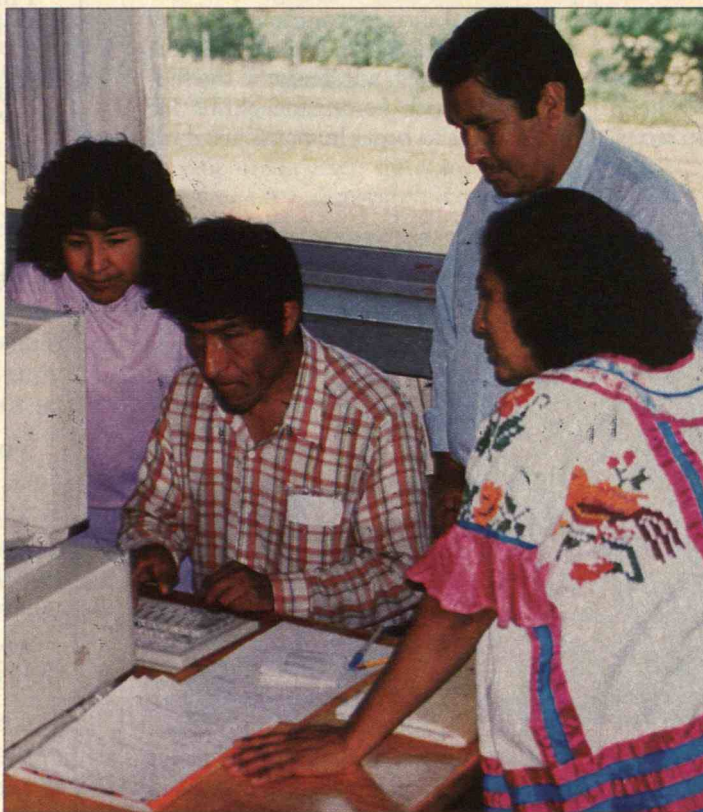
key variable is not the number of speakers but whether the language is being passed on to the next generation," he notes. "Without that, the languages are not just moribund, they are doomed." He points out that children are learning only 2 of the 20 native Alaskan languages spoken today. For example, the only person besides Krauss who knows Eyak, a language formerly spoken by hundreds of native Americans on Alaska's southern coast, is Marie Smith, age 72. Her children, like others in the community, speak only English.

With funds from the state of Alaska, Krauss has accepted a mission to document native Alaskan languages and provide materials and training for teachers that can help encourage bilingual education—a departure from past demands from Washington that only English be used in schools attended by native Americans.

Unless similar programs become more widespread, the loss of language diversity will be devastating, according to Kenneth Hale, a linguist at MIT and one of Bernard's mentors. Languages that have developed over millennia have been an evolutionary key to human survival, he says.

"They are a primary tool through which humans accumulate, articulate, and store knowledge."

Bernard echoes that sentiment. "With the wholesale reduction of lingual and cultural diversity, we will lose ideas that can help us adapt to new ways of living, including curing illness, acquiring food, raising children, and settling disputes," he says. "Of course, it's possible that the loss of language diversity may not hinder human adaptability in the future at all—but that's a bet I would rather not make." —SETH SHULMAN



Author Josepha Gonzalez Ventura (far right) shows a group of Aymara from Peru and Bolivia how to use special word-processing software to write in their indigenous language.

guage diversity worldwide. Michael Krauss, a linguist at the University of Alaska in Fairbanks who specializes in tracking disappearing languages, finds that as many as 90 percent of the world's 6,000 languages are currently threatened, spoken by shrinking numbers and taught to few children. "The

A Sucker for Bugs

With pesticide fears prompting consumers to cautiously examine fruit and vegetables in the supermarket bin, California farmers have begun devising novel chemical-free pest control techniques. By far the strangest of these is Bug Vac, a mega-Hoover that sucks bad bugs out of strawberry fields four rows at a time.

Basically a system of high-speed vacuum fans and suction hoses mounted on a tractor, Bug Vac sports a proboscis that extends in front of the tractor and rides about two inches above the plants. The snout sucks up bugs, grinds them into mulch, then spits the disarticulated parts out the back. Beneficial insects such as ladybugs that attack key pests fly away at the approach of the loud machine or live too deep in the plants to be sucked up.

The idea of bug vacuuming dates from the 1940s, when boll-weevil and grasshopper dozers were constructed. These machines, which blew streams of air across plants to direct insects into a collection bag, were used briefly for col-

Donald Neumann says his Grape Vac can remove 75 percent of marauding leafhoppers during each trip down a vine row.



Bug Vac, invented by entomologist Edward Show, sucks up 40 percent of the lygus bugs in this strawberry field in a single pass.

lecting insect samples but never adapted for commercial use.

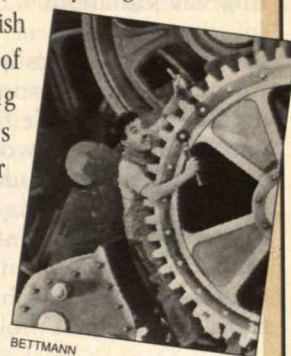
In the late 1980s, however, as many old standby chemical pesticides were banned and more insects became resistant to pesticides, researchers such as Edward Show, an entomologist at Driscoll Strawberry Associates, the second largest strawberry grower in California, began searching for alternatives. Experimenting with various techniques for drawing bugs away from crops—like planting bright flowers and alfalfa borders—Show started using a small, hand-held vacuum to gather bug samples.

The technique worked so well that Show after much tinkering managed to mount a more powerful vacuum on bicycle wheels. This rickshaw lookalike eliminated between 20 and 30 percent of lygus bugs, the bane of strawberry growers, which inject a chemical that deforms the fruit into grotesque shapes.

Based on that initial success, Driscoll Strawberry launched a full-scale engineering project that has produced progressively more effective machines that now collect about 40 percent of the lygus bugs per pass. In fact, one of the first growers to experiment with the more powerful units, Timothy Driscoll, president of Escalon Berry Farm, saved

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Technology Review acquires the right to publish the award-winning photographs, including honorable mentions, in one issue. Entries without return envelopes and sufficient postage will not be returned, and we cannot take responsibility for loss or damage. Please include cardboard for protection and your name on each slide cover or the back of each photograph, and note the type of film and photographic equipment used. We regret that we cannot take telephone calls about the contest.

Good luck!

enough on chemical costs to pay for his \$20,000 machine in the first year. "I no longer use insecticides," he says. "The only chemical I now spray is sulfur to treat mildew." Today dozens of these tractor-sized contraptions rumble through strawberry fields in the Salinas, Pajaro, and Santa Maria valleys.

Bug Vac Variations

Farmers have been busily modifying bug vacuums to suit their needs. Variations on the theme include the Beetle Vac, which in initial tests worked so well at controlling the Colorado potato beetle that farmers are hailing it as the salvation to serious bug infestations that available chemicals can't touch. Also, Prairie Dog Vac, which sucks the animals out of their holes and safely



Lettuce Vacs have proven less than optimal, as aphids and looper worms resist vacuuming by clinging deep inside the plants.

deposits them in a huge bag, has proven an effective alternative to standard rodent control techniques such as poisoning or trapping.

Growers of table grapes and wine grapes, with their neatly trellised rows of vines, believe the technique may work for them, too. Several have hung huge vacuums on old spray rigs and mechanical harvesters to control leafhoppers, which can suck the life from a vineyard and swarm around pickers at harvest

time. One equipment fabricator in Delano, Calif., Donald Neumann, has designed a grape vacuum that he claims can remove 50 to 75 percent of all leafhoppers in a vine row in one pass.

Yet while Bug Vacs may be effective on these farms, they may be inappropriate for other crops. John Inman, a Monterey County farm adviser, says that the machines "work on a few crops, mainly controlling small insects that live on top of plants," but contends that field tests of vacuuming broccoli, cauliflower, celery, and lettuce have been disappointing. "As with a lot of new inventions, there's a lot of hype surrounding Bug Vacs," he says. The reality is that "there's a fleet of abandoned machines rusting away on the farms around here."

Such was the case at Tanimura and Antle, the nation's second-largest lettuce grower. The company spent \$5 million developing a fleet of "Salad Vacs" but junked them because the two major lettuce pests, aphids and looper worms, cling tenaciously deep inside the plants and thus can't be efficiently vacuumed away. Tree-fruit growers, too, laugh at the concept, arguing that their orchard canopies are so vast and irregular that

they defy attempts to apply vacuum technology.

Thus, it's unlikely that vacuuming technology will expand beyond a few enterprising efforts. "You won't see John Deere or General Motors or the other big farm equipment manufacturers building any bug vacuums or launching R&D programs," says Robert Cantasano, an agricultural consultant credited with introducing many organic techniques to California farmers. "They operate on a mass market basis, and they just don't touch technology that might turn out to be appropriate for a few California crops."

—RICHARD STEVEN STREET



Earthquake Alarms

Twenty years ago, the Japanese planted seismic sensors along railways to alert their bullet trains to automatically shut down whenever an earthquake struck. Researchers are now working to further this concept with a computer-controlled electronic network of sensors that can detect a quake's initial tremors and send warnings to outlying areas up to a minute before the ground starts shaking.

Early warning systems are possible, explains Nafi Toksöz, a geophysicist at MIT, because seismic waves propagate through the earth's crust relatively slowly, about 3 to 5 miles per second, depending on an area's geology. An electronic signal travels nearly 50,000 times faster. Thus, a seismic detector sitting at the epicenter of a quake could electronically send an advanced warning to communities hundreds of miles away.

Had an early warning network been in place when a magnitude 8.6 earthquake rocked 400 miles of Alaska's coastline in 1964, many areas hardest hit could have been given at least a 30-second warning that the devastation was on its way. Such a system could also have given the residents of Mexico City about a minute to brace themselves for the crushing one-two punch of the twin quakes that shook their city in 1985.

Early warning systems would require an extensive network of rugged ground-motion detectors spaced every 5 to 10



Had an electronic early warning system been in place when an 8.6 earthquake hit Alaska in 1964, communities such as Anchorage could have received at least a 30-second warning.

miles or so along a fault line, says Hiroo Kanamori of Caltech's Seismological Laboratory. The systems would also re-

quire a fail-safe way to transmit the data, perhaps using satellite signals, he says, and would rely on sophisticated expert systems to instantaneously evaluate the source, location, and magnitude of a quake and route warnings to the appropriate areas along its path.

Automatic Shut Down

"Such networks could provide a vital margin of safety for people who work with dangerous chemicals in refineries or chemical plants," says Allan Lindh of the U.S. Geological Survey. In fact, a few systems have recently gone on line. In Japan, sophisticated sensors and computer networks are already in place to provide advance warning to nuclear power plants and public utilities. Tokyo Gas, for example, operates a 31-station seismic network that instantly shuts down the flow of gas through its gas lines after detecting the first wave from an earthquake's epicenter. The systems could also alert systems containing flammable substances to depressurize, incoming aircraft to seek alternate landing strips, computers to save data and secure their hard disks, and hospitals to switch on backup generators before power is lost, he says.

Support for the concept has been gaining momentum. A 1991 National Research Council committee recommended installing a prototype system by upgrading one of California's existing earthquake observation networks.

MIT's Toksöz maintains that California could develop a comprehensive system for less than \$100 million over the next five years.

But while few are opposed to the idea, a sticking point revolves around whether to include a more extensive—and expensive—network of civil-service alarms to notify the public that a quake is about to occur.

Many researchers who promote the notion of alerting electronic and mechanical devices are not as confident that warning people would be effective. "A 1-minute warning is not enough time for people to process the information and act on it," says Dennis Mileti, a sociologist at Colorado State University who studies the impact of warnings.

People would also first have to be convinced that the warnings were real, and not merely tests or a false alarm, he

says. If two out of every three times they sounded the quake did nothing more than shake one's coffee cup, the effectiveness of an alarm would greatly diminish. Thus, the system would have to be foolproof and highly accurate, which could add significantly to the cost.

Mileti also points out that people would need to learn how to respond. This, too, would require a major effort, he cautions. He cites one community in Hilo, Hawaii, that required a major commitment and several years to convince the population to run to high ground when the public siren sounded a tsunami warning. But he believes that installing public-alarm systems in selected institutions—such as schools, where children could be taught to duck and cover—could be enormously beneficial. —DAVID BJERKLIE (*The author is a science reporter for Time.*)



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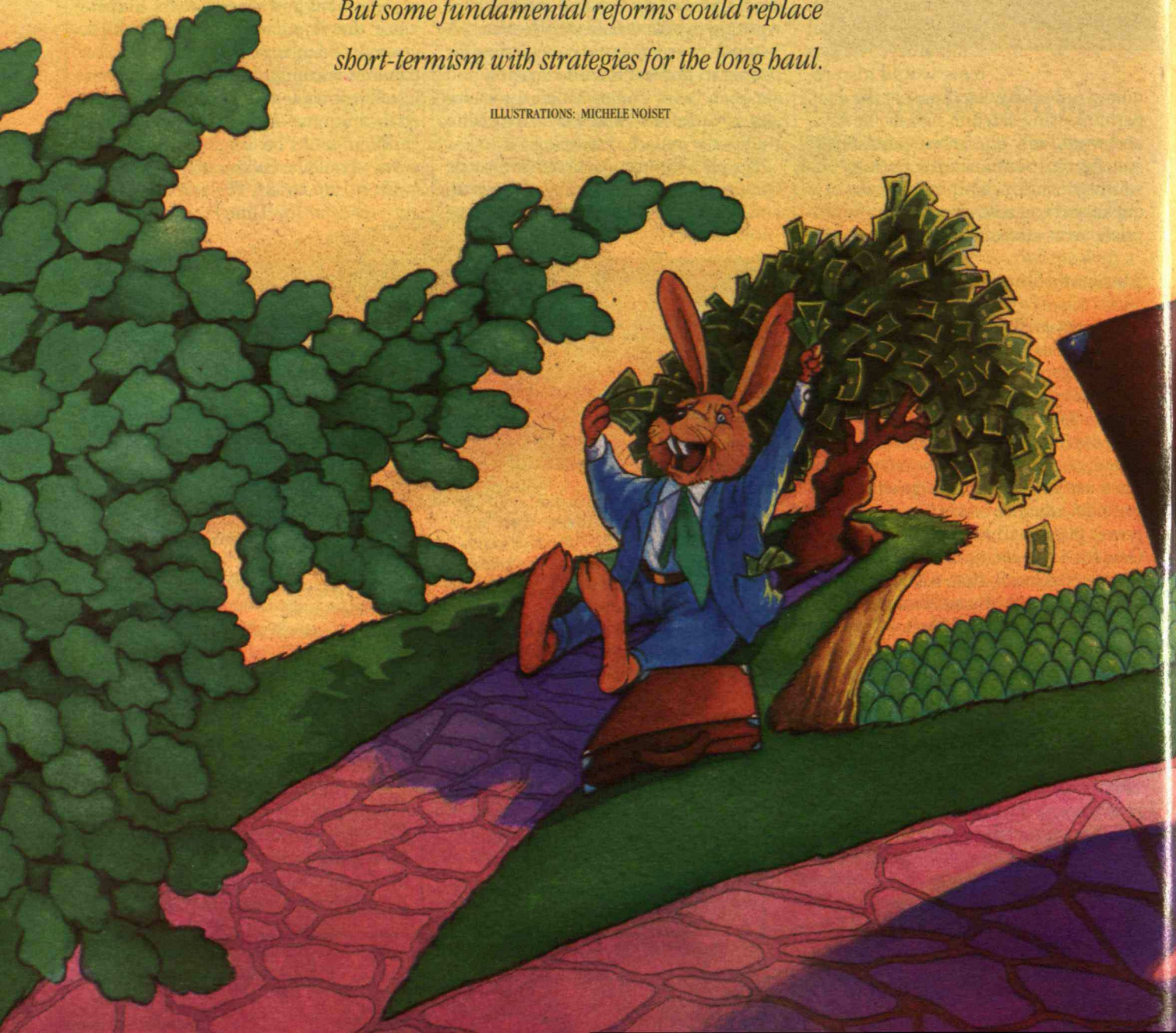


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Things the Tortoise Taught Us

Bent on quick profits like the hare of fable, U.S. industry is losing its technological edge. But some fundamental reforms could replace short-termism with strategies for the long haul.

ILLUSTRATIONS: MICHELE NOISET



By STEPHEN D. SOLOMON

In 1918 and 1919, the Du Pont Co. acquired more than a quarter of the shares of General Motors. By the early 1920s, as the auto industry struggled with swollen inventories, GM's market share plummeted from 17 percent to 12 percent in one year. Instead of jumping ship, Du Pont invested even more capital. Pierre S. du Pont himself moved over to run GM for several years, providing the leadership to rebuild the enterprise into an industrial powerhouse. * **T**he automaker could



have used a Pierre du Pont in the early 1980s. As GM's market share began a decade-long slide from 45 percent down to 35 percent, neither board members nor shareholders held management accountable. Only in October 1992, after millions of customers had fled to other nameplates, did the company's directors at last act decisively by installing a new management team.

Weak leadership is not GM's problem alone. A major reason for the decline in the nation's economic competitiveness, according to a growing number of business leaders and academic experts, is the absence of significant pressure from shareholders and directors on corporate managers to answer for poor long-term performance. The recent flexing of shareholders' muscles in deposing the top executives of GM, IBM, Digital Equipment, and a handful of other large companies may presage a new era of increased oversight by directors and shareholders. But even at those companies, it took years of decline—and what may turn out to be, in some cases, a permanent loss of market leadership—before the owners and directors finally delivered pink slips to the executives in charge.

The current system of corporate governance actually promotes the kind of short-term thinking that can erode a company's competitiveness year by year. "The emphasis is on stock price, which favors a focus on short-term financial performance," says Jay Lorsch, a senior associate dean at the Harvard Business School and author of *Pawns and Potentates*, a study of corporate directors. The result, according to an international study done for the Council on Competitiveness, a private group including corporate executives, union officials, and academic experts, is that U.S. firms report that only 21 percent of their R&D investments are long term—with profits not expected for at least five years—compared with 47 percent by Japanese companies and 61 percent by European companies.

The weight given to quick returns has made it especially difficult for companies to compete in technology markets, which require long-term investment in risky projects. High-tech products and markets often develop in unexpected ways or not at all, making it virtually impossible to predict financial performance five or ten years hence. "Quick returns are fundamentally incompatible with what it takes to grow a business, particularly one based on technology," says Joseph G. Morone,

director of the Center for Science and Technology at Rensselaer Polytechnic Institute and author of *Winning in High-Tech Markets*. "All the things you do to create tomorrow's business hurt the bottom line today. You're going to be penalized by the stock market."

The source of today's short-term thinking, say many critics, lies in the growing divergence of interests between the owners of America's corporations and the managers who run them. The problem is that corporate America does not have enough owners—or at least real owners who care.

The principal owners are institutional investors—banks, mutual funds, pension funds, and insurance companies. Since 1950 their holdings have mushroomed from 8 percent to 60 percent of total equity in publicly traded companies. With assets totaling \$5.8 trillion in 1990, they act as agents for millions of people who have entrusted them with their savings or pension money.

Yet because institutional money is fragmented and transient, these big investors exercise virtually no direction over how the corporations in their portfolios are run. While a mutual fund may have billions of dollars in assets, it typically spreads that money over hundreds of companies, rarely holding more than 1 percent of the shares of any one corporation. In buying and selling shares, the typical mutual fund manager has time to examine only the performance yardsticks that are easiest to grasp—near-term profit forecasts—penalizing companies that sacrifice current earnings to build the business for the long haul. And the fund managers trade their stock often, in search of better investment opportunities; today the average share of stock is held for less than two years, compared with seven years in 1960.

Corporate managers understand the implications of a stock market dominated by institutions. In case they miss that cue, their own compensation packages usually dangle bonuses and stock options that reward short-term performance in profits and stock price.

Corporate executives who want to dress up for Wall Street steer away from uncertain R&D projects and heavy investments in intangibles such as employee training; they look instead to improve their existing business incrementally. A frequent result is good financial returns in the short run but declining competitiveness down the road.

When the bad news finally shows up in a company's financial reports, there is rarely anyone around to hold management accountable. Financial institutions typi-



GM SAVIOR
PIERRE S. DU PONT,
AROUND 1930.

STEPHEN D. SOLOMON is a professor of journalism and mass communication at New York University and a former senior editor of Inc.

cally dump their stock rather than fight to oust a failing CEO and turn the company around. The board of directors is usually hand-picked by the CEO, so there is rarely any demand for accountability there either. "Who is going to call them on the carpet, try to make them rethink their strategy, or if necessary tell them, 'You were great for the 1970s but your skills are not the right skills for the 1990s?'" asks Mark Rowe, a professor of law at Columbia University and an expert on corporate governance. "There is nobody who can really do that. The people with the incentives would be large stockholders, which we don't have in the U.S."

How did this fragmentation of corporate ownership come about? The principal cause is legislation designed to encourage just that. As a result of financial scandals at the turn of the century, Congress has passed numerous laws that limit the power of individual financial institutions over the economy, splintering ownership of U.S. corporations as a result.

Banks, for example, are prohibited from directly owning stock in industrial companies. Bank holding companies enjoy only slightly more leeway: their activities must be closely related to banking, and they are not allowed to own more than 5 percent of the voting stock of a nonbanking company. And insurance companies operate under state laws that generally permit no more than 20 percent of their assets, or half their surplus, to be invested in stock, with no more than 2 percent invested in any single stock.

Pension funds, the largest institutional holders of stock, are required by law to be widely diversified in their holdings, in large part to enhance the security of the retirement money they hold. The same is true of mutual funds: they must be broadly diversified to gain favorable tax treatment, and regulations discourage them from owning more than 5 percent of any one company's stock—a restriction explicitly intended to prevent them from gaining control.

To encourage U.S. companies to invest for the long term, some business and academic leaders are calling for fundamental changes in public policy. Their proposals go beyond the tax incentives and infrastructure spending that have been widely discussed by the Clinton administration. They put forth an entirely new set of measures designed to influence the way managers plan and invest—measures designed to reduce the fragmentation of corporate ownership and intensify the oversight by owners and directors.

Raise the Stakes for Institutional Investors

Michael E. Porter, a professor of business administration at the Harvard Business School, argues that institutional investors should play a larger role in overseeing



A
"lead director"
could spur a
sluggish corporate
board by evaluating
management and
reporting back
to shareholders.

the activities of companies in their portfolios and even take seats on boards of directors. Porter's study *Capital Choices*, which draws on research by 25 leading scholars in business and economics, urges the United States to follow the example of Germany and Japan.

In those countries, institutional investors take significant ownership stakes in a relatively few companies. They play an active role in the companies in which they invest, gathering information about the company and its industry, monitoring performance, and, when necessary, exerting influence over senior managers.

When institutions own large blocks of shares, pressure on corporate executives to invest for the long term is a natural consequence. Large owners tend to be stable owners—they find it difficult to dump their stock without driving down the price sharply and hurting themselves in the process, so much of their reward comes from the long-term growth of their investment rather than short-term trading profits. Large owners are also better able to justify the high costs of collecting and analyzing information and aggressively putting forth their views to executives and directors.

"Generally speaking, the more concentrated and dominant the ownership, the longer the time horizons a company sets," says Robert A. Eisenbeis, a professor of banking at the University of North Carolina who has studied institutional ownership in Japan, Germany, and the United States. "There is more of an alignment of interests and more exchange of information."

Adopting the German and Japanese model would require easing laws that many analysts feel have outlived their usefulness. When legislation restricting investments by big institutions was enacted early in the century, says Warren E. Farb, senior economic adviser for the Office of Policy Analysis at the U.S. Department of Commerce, "there was no idea how it would affect competitiveness 50 years later. We must stop and analyze whether these rules to address old problems are still doing the total economy a service."

Porter urges that diversification rules be loosened, maintaining that the portfolio of a pension fund or insurance company can be secure even if it contains the stock of far fewer than 100 companies. He also recommends that pension funds be permitted to own as much as 20 percent of the shares of their sponsoring company; today's limit is 10 percent.

The pension recommendation does not sit well with some labor leaders who believe that workers run a double financial risk when both their employment and a large portion of their pension are tied to the same company. "Pension funds represent deferred income to the workers, and prudence should be the only consideration," says Howard D. Samuel, president of the industrial union department of the AFL-CIO. "Workers

could lose both their jobs and a big piece of their pensions if their own company goes belly up." But Porter argues that a bigger ownership stake gives workers and managers more incentive to ensure that their company is well run, and thus actually increases job security.

Banks could also be instrumental in focusing companies on building long-term value. Michael T. Jacobs, a former U.S. Treasury official and the author of *Short-Term America*, says banks should be permitted to hold significant blocks of stock and that bank representatives should sit on the boards of companies to which they make loans. "If a bank does nothing but lend money, it only wants its money back, with interest," says Jacobs. "But if it has a big equity stake, it will want that big stock holding to grow in value over the long term." With their own rewards changed, he says, banks would be more likely to insist that corporate managers look beyond the next quarterly earnings statement and invest in long-term opportunities. And they would have a strong incentive to help their customers in hard times rather than simply calling the loan.

As evidence, Jacobs points to the positive role played by German and Japanese banks, many of which hold large blocks of stock in borrower companies. Executives of Deutsche Bank, for example, sit on the boards of more than 400 companies. When managerial problems beset Daimler-Benz a few years ago, Deutsche Bank, which controls about a quarter of the automaker's stock, stepped in and replaced the senior management.

Loosening the restrictions on banks is controversial. Their horrendous losses on Third World loans and real estate raise serious questions about their ability to make wise equity investments. Some skeptics believe it is an experiment worth trying, but only by degrees and with the kind of federal oversight that was absent in the 1980s as hundreds of savings and loans tumbled over the precipice. "I wouldn't rush into it," says George Hatosopoulos, chairman and chief executive of Thermo Electron Corp. and formerly chairman of the Federal Reserve Bank of Boston. "We have enough problems with banks. In Germany, the system evolved over many years. If we let banks own equity, we should do it gradually, so we can see how they deal with these bigger holdings."

For institutional investors generally, the biggest obstacle to loosening restrictions may be the traditional American fear of concentrated power. Turn back the regulatory clocks to the turn of the century, the argument goes, and the ghosts of the robber barons striking deals in smoke-filled rooms will haunt the U.S. economy. Advocates of change say abuses on such a scale are unlikely because the passage of a century has so altered the economic landscape. "If these proposals would lead to three financial institutions owning all the significant assets in the country, the fear would be justified," says

Mark Rowe at Columbia. "But there's a big distance between what we have now—a kind of hyper-fragmentation—and that scenario. We've got, for example, about 12,000 banks in this country. It's plausible to experiment with shifting a bit, and then reevaluate and see whether we should shift a little bit more."

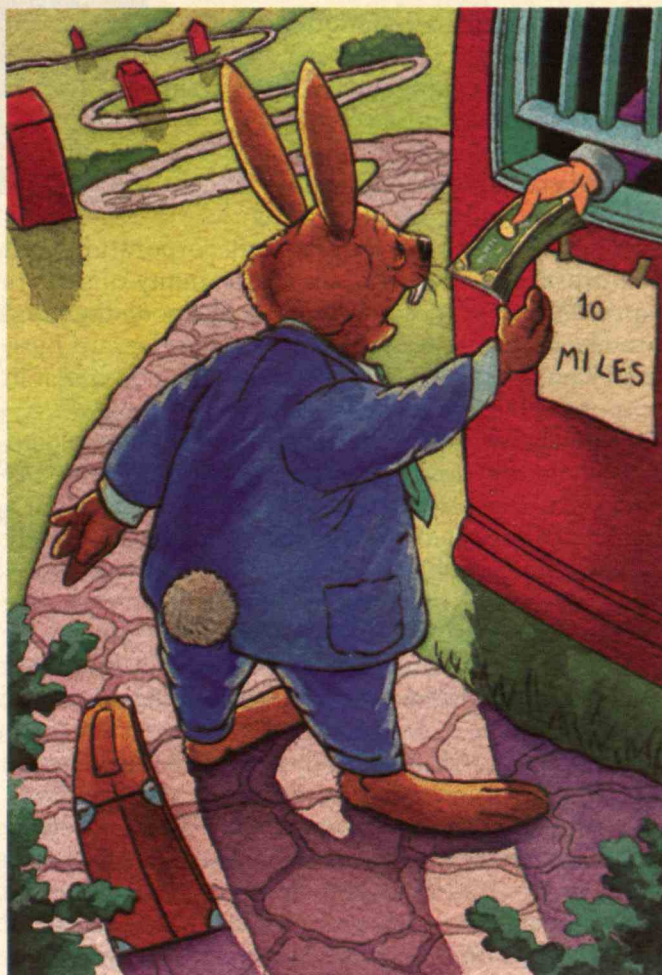
Encourage the "Buddy System"

Louis Lowenstein, a professor of finance and law and director of the Institutional Investor Project at Columbia University, sees large investments as a route to fruitful long-term partnerships between firms. When one company owns 15 or 20 percent or more of another company's stock, the futures of the two businesses are so intertwined that neither can abandon the other without harming itself. Lowenstein is fond of recounting the benefits of Du Pont's ownership share in General Motors, which reached 36 percent in the 1920s. "Unless GM grew and prospered," he says, "there would be no profit for Du Pont. There was no way to hedge, no puts or calls that would allow Du Pont's investment to be saved if GM failed."

Lowenstein calls the marriage of one large corporation to another through shareholding the "buddy system." "It's a relationship that builds on long-standing loyalties and commitments that run both ways," he says.

According to Lowenstein, the closest example of the buddy system today is the investment philosophy of Berkshire Hathaway and its chairman, Warren Buffett. Though an investment company rather than an operating company like Du Pont, Berkshire Hathaway has bought hundreds of millions of dollars worth of stock in each of a handful of corporations. Buffett hangs on to a stock for years, vigorously monitoring the company's performance and ensuring that management invests to build the business over the long term. When a treasury bond trading scandal hit Salomon Brothers in 1991, Buffett installed a new management team and helped smooth relations with the U.S. Department of the Treasury. As Salomon's biggest shareholder, Buffett could not cut and run. "We believe that according the name 'investors' to institutions that trade actively is like calling someone who repeatedly engages in one-night stands a romantic," he says.

So why don't more companies invest as "buddies"? Tax and accounting rules discourage the practice. For example, unless an investing corporation owns 20 percent or more of another company's stock, it cannot include any of that company's profits in its own earnings reports—a prohibition that can hurt the investing corporation's stock price. Few can afford to own more than 20 percent, especially if the target company is



Instead

of being guaranteed
big money, CEOs
could take their
pay in increments
as a company
reaches specified
goals.

large. "Sometimes accounting determines behavior instead of simply reflecting it," says Lowenstein. "We should get accounting out of the way," he says, by easing the rules on reporting earnings.

Strengthen the Board of Directors

Curing the short-term focus of U.S. corporations will require strong boards of directors, many observers agree. "Directors need to act more like potentates and less like pawns," says Jay Lorsch, of the Harvard Business School. "The directors should be the power seat in corporate governance."

Directors are supposed to represent the shareholders, actively monitoring the performance of the company and its top executives. In fact, the recent upheavals at a handful of large companies notwithstanding, that rarely happens. One problem is a major conflict of interest: a 1992 report by Korn/Ferry International, an executive search firm, revealed that 80 percent of the companies it surveyed reported that their chief executive also served as chairman of the board of directors—a classic case of students grading their own papers.

What's more, CEOs typically hand-pick the directors, who may be officers of the company or "independents" without employment or business ties to the corporation. Many independent directors are CEOs of other companies or serve on half a dozen other boards, leaving them little time to learn the intricacies of another business. Korn/Ferry found that directors spent 125 hours on board duties in 1983 and only 94 hours in 1992.

Why don't the actual owners serve as directors? Most stockholders are passive owners—either institutional investors who hold the stock only for a few months or have too meager an ownership stake to demand a seat on the board, or small individual investors who have no practical way of influencing management even if they wanted to. Although most boards have committees that nominate candidates for seats, as a practical matter the CEO controls nominations in most companies. Only this official slate of nominees is presented to shareholders on the company's proxy card. Many shareholders simply toss away the card and do not vote—an abstention that is usually counted as a vote *for* the official slate.

"The franchise of shareholders is comparable to Albanian voters whose option is to vote or not to vote with the knowledge that the slate or the program will go through no matter what they do," says Robert A.G. Monks, former chairman of the Boston Company and leader of an unsuccessful movement to elect a new slate of directors for Sears, Roebuck and Co.

Even if they want to, shareholders do not have an easy time waging a campaign to elect their own directors. The cost of soliciting shareholders' votes is so high that it

is virtually impossible to replace a majority of the board without a hostile raider footing the bill.

To make boards of directors more effective, Michael Jacobs suggests that the Securities and Exchange Commission change proxy rules so any group representing 5 percent of a company's shares can nominate someone to serve as director and include a testimonial in the proxy statement the company circulates to shareholders. Although critics say this would saddle companies with an added expense, Jacobs argues that the proxy statement is paid for by shareholders and thus should give them a real choice in the election of those who are supposed to represent their interests.

Changing laws or SEC regulations can mean an arduous political battle, however. Hoping to avoid such delay, Lorsch and Martin Lipton, a New York corporate lawyer who represented a group of GM's directors when they ousted senior management last October, have proposed a set of reforms that companies can implement on their own. They recommend that companies reduce the size of their boards to 8 or 9 directors, from the present range of 12 to 16. A large board, they say, by its nature inhibits discussion and dissent and enables busy directors to slide by without much work. "A smaller board gives them more time to talk with each other and participate in meetings," says Lorsch.

Lorsch and Lipton also suggest that each board select from among its independent directors a "lead director." This person would be a counterweight to a CEO who also serves as chairman. The lead director would play a major role in nominating new board members and in regularly evaluating the CEO's performance on the basis of both long- and short-range goals. If the company failed to meet its goals in three out of five years, the lead director and other independents would produce a special section of the annual report to shareholders explaining the problem and what was being done to correct it—in contrast to the evasions and half-truths offered to shareholders of troubled companies in annual reports today. "The idea is to have directors commit themselves seriously to looking after the health and welfare of the corporation," says Lorsch. "I want to see directors monitoring management so we have fewer catastrophes in the future."

Tie Compensation to Long-Term Gains

Unfortunately, CEOs earn big money—sometimes tens of millions per year—for good performance or bad, further undermining efforts to focus on the long term.

Harvard's Michael Porter, who calls executive pay "out of control," urges an overhaul of compensation practices. Performance awards, he says, should be based not on current profits but at least in part on improve-



If

the reformers prevail,
investors might act as real
owners, helping to remedy
poor performance
instead of simply
dumping their stock.

ments in the company's competitive position, which could include such measures as market share and productivity gains. Stock options should carry at least a five-year vesting period as an incentive to build the company's value over time, he says.

Even these reforms do not go far enough for Jacobs. He argues that top executives are paid so much—typically 100 times the average wage of a factory worker—that performance rewards do not materially affect their lifestyle and thus may not greatly influence their behavior. Instead, Jacobs suggests that chief executives be paid like law partners and investment bankers; they would take a quarter of their potential pay as regular salary, with another quarter paid out if they attain a specified performance level. The rest would be tied to corporate performance over a five- or ten-year period and be accrued each year in the form of stock or stock options.

To make directors feel more personally vested in a company, some observers say they, too, should be paid in shares of stock instead of cash. "Top managers and the directors of a company should have a sizable stake," says Thermo Electron's Hatsopoulos. "It can work wonders focusing their attention on the long term. We should require a minimum ownership of stock before people even qualify as directors. And there should be restrictions on selling the stock."

Overcoming Inertia

How many of these changes are we likely to see in the next few years? Already there is momentum on several fronts. Spurred by relentlessly poor performance, restive directors and stockholders have forced out the top executives at such major companies as GM, IBM, Compaq Computer, and American Express, and forced another laggard—Sears, Roebuck—to restructure its business.

A small number of institutional investors, led by the California Public Employees Retirement System, have become more aggressive in overseeing corporate performance. The California fund, which holds stock in more than 1,000 companies in its \$22 billion portfolio, targets a dozen poorly performing companies each year and urges remedial measures.

Last October, the Securities and Exchange Commission approved new rules that open boardrooms to more

oversight by shareholders. The rules require publicly traded companies to disclose executive pay in detail, ending an era in which huge compensation packages were often shrouded in explanations so confusing that few shareholders could understand them. The SEC also changed another set of rules to make institutional investors freer to communicate with one another about the policies of companies in which they own stock.

The arrival of the Clinton administration should bring further visibility to many issues involving corporate governance and financial markets. "The new administration has the prospect of being more open to these issues than the last

one," says Howard Rosen, executive director of the congressional Competitiveness Policy Council. "It seems more receptive to the idea of government playing a role in improving competitiveness."

Still, significant change will be slow in coming. Any move to free institutional investors to take larger holdings in individual companies will collide with the enduring mistrust of concentrated economic power. If the misdeeds of the robber barons are by now only dimly remembered, memories are fresh of the Wall Street scandals of the late 1980s and of the fraud and abuse in the savings and loan industry.

What's more, proposals for reform will stir up opposition from a vast array of threatened parties. "There's a lot of interest in these ideas on the Hill," says one Senate staffer. "But a whole host of people with an agenda in their back pockets will come out." One such group is the business community itself. Corporate executives like the system the way it is—with control residing in their own hands and a minimum of outside oversight. "Underneath the façade of civil dialogue is a power struggle," says Monks, the shareholder activist. "Some executives perceive that the reforms would diminish their power. And in fact they would."

But if the reformers prevail, their ideas could restore long-term thinking to many corporations. They might inspire more investors to act as real owners, interested in the long-term health of the companies whose stock they hold and less willing to follow the Wall Street Rule: If you don't like the way a company is performing, dump the stock. By bringing the interests of owners and managers into closer alignment, the reformers could create a new model for restoring the competitiveness of U.S. businesses. ■

Advantageous Liaisons

BY WILLIAM C. TAFFEL

COLLABORATIONS BETWEEN U.S. AND JAPANESE COMPANIES CAN ALLOW BOTH SIDES TO PROFIT FROM, AND EVEN HELP CREATE, THE NEW WORLD ECONOMIC ORDER.

IT is almost a cliché by now that Americans are good at inventing things but not at commercializing them, and that Japanese are weak at invention but unsurpassed at commercialization. Although this comparison obviously oversimplifies, it is essentially true. 🍀 In the United States, children are encouraged to think independently, to take the initiative, and to excel. The country's history is a continuing saga of the pioneer ethic—of breaking away from the crowd and carving out a new place in a new world. Because these values hold true just as much in engineering innovation, the United States has traditionally produced a bumper crop of individuals who develop new technologies and dream up business ideas that are significant departures from the past. 🍀 In Japan, by contrast, “the nail that sticks up is hammered down.” Students are encouraged to avoid outdoing their peers, and adults as well as children



JAREK LINN

are conditioned to obey authority, not ask questions, and say what they think the listener wants to hear. Successful people in Japanese organizations are those who have managed to blend in and persist doggedly through years of seniority building. In such an environment, it is unlikely that an individual will express the creative spark to generate truly new ideas.

While people in both countries are proud of the strengths that have yielded their particular successes, they are also painfully aware of their national shortcomings. The fact that the Japanese have commercial skills that Americans lack appears to present a clear challenge to U.S. industry to develop comparable skills. Some Japanese, meanwhile, see the need to acquire enough of the Western pioneering spirit to enable pathfinding of their own. But rather than attempt futile make-overs, competing fruitlessly in inappropriate cultural environments, there is a better idea: collaboration. Combining strengths to offset each other's deficiencies, Japan and the United States can create powerful ventures from which both sides can hugely benefit.

The need for such outreach has been no secret to the Japanese. For years, Japan addressed its weakness in basic research and invention by obtaining technology from the West, through either partnerships or licensing. U.S. companies that transferred this technology to Japanese companies have often been chided for making a strategic mistake. But the real mistake was that they did not gain much in exchange. U.S. companies frequently entered such relationships seeking a fast return—a big license fee, quick sales in the Japanese market—and paid little attention to the opportunities for learning from their Japanese partners.

Today the picture has changed. U.S. companies are much more globally oriented and much more savvy in their dealings with Japanese companies. They increasingly enter collaborative relationships with a clear eye toward what they want to gain, what they want to learn, and exactly how much they are willing to give away in the process.

Partnerships Worth the RISC

The computer industry provides good examples of the two countries' respective technological strengths and the changing nature of U.S./Japanese partnerships.

Semiconductor integrated circuits—particularly dynamic random-access memories (DRAMs)—were pioneered largely in the United States by such notable companies as Texas Instruments, Intel, and National Semiconductor. Until the 1980s these firms clearly dom-

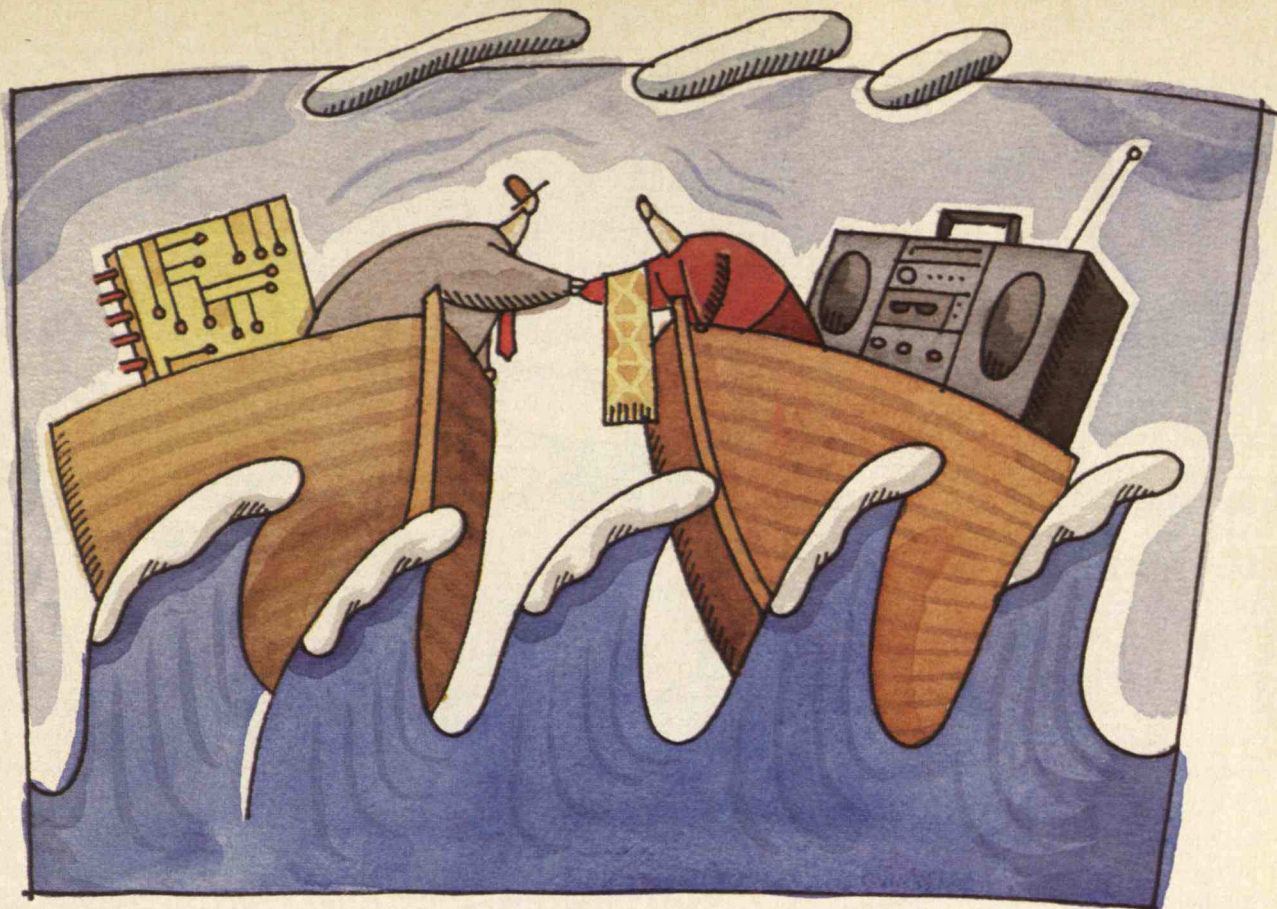
inated the industry, technologically and in market share. During the early 1980s, however, the big Japanese electronics *keiretsus* (conglomerates) began moving into semiconductors, supported by a government-managed research program. A few years and billions of dollars later, Nippon Electric Corp. (NEC), Toshiba, Hitachi, and other Japanese companies had muscled their way from relative obscurity in DRAM markets to a powerfully commanding position, driving most of the U.S. pioneers out.

There is still much debate over whether three major issues—the activist role of the Japanese government, manufacturers' membership in *keiretsus* (while their American counterparts were stand-alone), and the Japanese dumping of DRAMs in the United States while the Japanese market was closed—were real problems or simply excuses on the part of “weak” U.S. firms. But one thing is certain: the Japanese worked tirelessly to improve semiconductor process technology at the margins, enabling them to put more and more lines of circuitry in less and less space on a piece of silicon and thereby allowing the same basic design to be replicated many more times on a single chip in each succeeding generation. In so doing, they boosted the quality and reliability of their product well above that of their American counterparts.

During the same time, however, computer vendors in the United States began to see that the prevailing computing style—complex instruction set computing, or CISC—could not continue supporting great increases in processing speed. CISC design, which combined many processing steps into single instructions, was also more complicated and therefore slower. A leaner and meaner computing architecture—reduced instruction set computing, or RISC—therefore came to the fore, based on the idea that a processor designed to interpret only a small number of simple instructions at a time would be much more efficient. Within a few years, several U.S. companies had developed leading-edge RISC microprocessors that provided price/performance benefits well beyond those of the available CISC models. This fundamental technological shift transformed the computer industry, creating significant new competitors whose RISC technology seriously challenged the positions of traditional market leaders.

It is not surprising that the shift from CISC to RISC would be driven by U.S. companies. It is even more characteristically American that the original impetus would come from two start-ups, Sun Microsystems and MIPS Co., which in a few years grew from tiny companies to major players. Established U.S. vendors like International Business Machines (IBM), Hewlett-Packard (HP), and Digital Equipment Corp. (DEC) were slower off the mark because they had strong CISC designs in place. But they soon followed suit, each developing

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**THE NEW RELATIONSHIPS
ARE MATCHES BETWEEN EQUALS,
WITH EACH CONTRIBUTING THEIR
PARTICULAR TECHNOLOGICAL
SKILLS.**

a unique and advanced version of the new computing style.

The most recent RISC architecture, the Alpha AXP introduced by DEC, exemplifies the advantages that the American style of thinking provides to U.S. companies. To make the Alpha microprocessor, engineers had to take the same process steps for producing DRAMs—long optimized by the Japanese for volume production—and rearrange them. A simple extrapolation of existing techniques would not have sufficed; DEC's engineers had to break old molds and invent new ways of thinking about semiconductor processes. The result was a combination of steps in unique and sometimes counterintuitive sequences. For example, driving the Alpha AXP processor at a faster rate required more power than that of a typical DRAM. This required changes in the power circuitry, which in turn required changes in the process for depositing certain metallic layers of the chip. The greater power consumption also required adjustments in other aspects of the chip layout and process design to avoid overheating. Such a departure from "tradition"—virtually the norm in the United States—would have been difficult to achieve in Japan.

That was one reason why, as RISC technology was sweeping the United States in the late 1980s, Japanese companies once again looked to the U.S. Despite repeated efforts, both alone and together in govern-

ment-sponsored research efforts, these firms could not match U.S. companies in the design and manufacture of advanced microprocessors. Within a few years, therefore, virtually every major Japanese company had tied up with an

American RISC designer: Fujitsu and Toshiba with Sun Microsystems, NEC and Sony with MIPS, Hitachi and Oki with Hewlett-Packard. But this time the U.S. companies have clear strategic goals, such as taking advantage of Japanese manufacturing skills. The new relationships are matches between equals, each contributing technological capabilities.

In the RISC arena, U.S. companies are collaborating with Japanese companies primarily to reach markets unavailable to U.S. microprocessor designs by themselves. The Hitachi/Hewlett-Packard partnership is a case in point. HP has great engineering talent, as evidenced by the advanced Precision Architecture microprocessor that has been particularly successful in the company's workstation products, but its semiconductor capability and financial resources are relatively modest. Hitachi has outstanding semiconductor process technology and tremendous financial resources but has had only limited success in microprocessor development. Thus Hewlett-Packard and Hitachi are now pooling complementary technology in an arrangement that will

Continued on page 34

Attitude Adjustment



BY LEON TRILLING

THE U.S.

AIRCRAFT

INDUSTRY

MUST LEARN TO

PARTICIPATE MORE

EFFECTIVELY IN

INTERNATIONAL

COLLABORATIONS.

THE commercial aircraft industry is often held up as a brilliant example—albeit one of the last remaining examples—of America's undisputed world dominance of a major high-tech market. The nation's aircraft business is the largest and most profitable in the world, employing more than a million workers and producing a \$30-billion surplus for the U.S. balance of trade. For example, Pratt & Whitney and General Electric together own more than 80 percent of the world's aircraft engine business, while Boeing enjoys a 60-percent share of the airframe market.

The outlook for the foreseeable future seems equally bright. The four major U.S. carriers—Delta, American, United, and Northwest—have ordered some 2,500

U.S.-built planes, each of which will sell for between \$75 million and \$150 million. Worldwide demand for commercial air transportation, which drives the system, is expected to continue climbing steadily at about 6 percent per year, as it has done since the end of World War II. And analysts point to China and much of the developing world, where air travel often represents the most practical mode of transportation, as huge untapped markets waiting to be served.

Yet despite such optimistic forecasts, the nation's commercial aircraft industry may be in for a rough ride, as technological leadership—the key to future success in aerospace—is drifting away from U.S. corporations.

At one time, simply build-

ing more planes might have been the way to meet increased demand for air transport. But existing airports, at least those in the West, have become so crowded that they cannot handle more traffic. Also because there is little hope of building more or larger airports near major hubs, aircraft manufacturers will have to introduce larger and faster aircraft to carry more passengers to their destinations more quickly. Perhaps even more important, they will also have to equip aircraft with sophisticated electronics to enable planes to take off and land with greater precision and speed, thereby increasing airport "throughput."

To design this next generation of aircraft, U.S. airframe and engine manufacturers

must have access to the latest research in broad disciplines such as materials, mechanics, energy processing, controls, and avionics. They also need skill in designing and testing smaller, lightweight components as well as integrating them into the new vehicles.

U.S. manufacturers could once look for research support from the military establishment, which has long been an economic flywheel and a technological pacesetter in the aircraft industry. But defense R&D is evaporating and diverging from commercial needs. In fact, while some 75 percent of aerospace R&D funds from 1945 to 1990 were allocated through the military budget, only one-third was spent on basic and applied research. The remainder went toward developing stealthy, supersonic aircraft and ballistic-weapons systems, with little direct commercial relevance.

U.S. air transport industries could also once rely more on civil agencies, especially NASA, which has a statutory requirement to do research in aeronautics as well as astronautics. This is the route taken by most European countries, where government agencies conduct substantial research programs to support their national aircraft industries. But NASA support is inadequate because since 1960 most of NASA's funds and efforts have been devoted to support the space program.

U.S. aircraft producers could also consider joining forces to share the latest technological research. But the U.S. government has still not determined how much collaboration on generic research by competing corporations is permissible under anti-trust laws.

Consequently, the U.S. aircraft industry has been forced to look overseas for technological collaborators. For instance, Boeing calls upon hundreds of associates in Europe and the Far East to supply parts of the wings, fuselage, and tail controls for its new 777 jetliner, scheduled for release in 1995. However, the company carefully controls the entire design, manufacturing, and assembly process.

Other companies are more willing to relinquish such control—and thus risk building up potential competitors—in return for short-term financial support. In fact, several U.S. manufacturers have recently joined international consortia made up of risk-sharing partners. General Electric, for example, has engaged SNECMA (a French aerospace engine manufacturer), IHI (a Japanese aerospace engine manufacturer), Volvo of Sweden, and Fiat of Italy as partners in developing its new GE90 engine.

Both the Boeing and the GE approaches provide access to capital from a wide variety of sources, ease entry into the international market,

and tap specialized skills wherever they may be. But joint ventures complicate the management of the design and manufacturing process and have serious implications as vehicles of technology transfer. In fact, some observers fear that U.S. companies will give away more than they will gain. For example, Boeing's partnership with Mitsubishi Heavy Industries, Kawasaki, and Fuji on the 777 project is viewed by many as an attempt by the Japanese to acquire expertise in systems integration—one of Boeing's competitive advantages.

Clearly U.S. aircraft corporations must learn to resolve such issues, for joining consortia is their only hope for maintaining a strong position in the commercial aircraft industry. The best approach would be to assume a leading role, much as Boeing did in managing its 777 program. As team leaders, they would retain substantial control over design decisions and the crucial process of integrating system components. They would gain the edge in leading future projects because of their experience. And other U.S. industries would gain easier access to a wide range of new technologies.

To qualify for consortia leadership positions, firms must possess four main attributes: a record of achievement, access to capital, a wide range of potential customers, and continuing access to the

latest research. U.S. aircraft industries measure up fairly well. They have a sterling record of achievement. They have reasonable access to private capital thanks to their large order backlog and the breadth of their corporate activities—which include substantial military business and, in the case of GE and Pratt & Whitney, the varied interests of the parent corporations. And their main customers include a number of domestic and foreign airlines, leasing companies, and the U.S. military. However, they come up short in the area of advanced research.

Therefore, they need to maintain their strength in composite materials, smart engines, flight-control avionics, and global-positioning systems. This is most effectively done by strengthening the U.S. generic research base, using public agencies. At NASA, the new administrator, Daniel Goldin, has pushed for more effort in aeronautics. Air Force laboratories, such as those at Wright Patterson AFB in Dayton, Ohio, and at Arnold Engineering Development Center, in Tullahoma, Tenn., could also usefully convert their considerable facilities and skilled staff to such research and thereby strengthen their claim to continued support. ■

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also save money: by sharing the substantial costs of this effort, each partner is able to reduce its own investment considerably.

A Rash of Marriages

The RISC collaborations reflect a larger trend: more and more U.S. companies are seeking Japanese allies in order to address global markets. IBM and Toshiba, for example, have formed Display Technologies, a joint venture to develop and manufacture color liquid crystal displays (LCDs). Toshiba provides the LCD technology, which is now almost the exclusive domain of Japanese companies, while IBM brings advanced personal-computer technology together with massive demand, through IBM's own product sales, for the joint venture's products.

IBM and Canon have announced a cooperative effort to build PCs incorporating Canon's microprinter technology. IBM has little expertise in small-printer technology, and despite continuous efforts, IBM (and most computer makers) have not yet managed to produce PCs with the convenience and attractive appearance characteristic of Japanese consumer-electronic devices. Canon, meanwhile, is a world leader in small-printer technology and is also experienced in developing attractive products for both office and home that are easy to use and maintain. Yet it has had little success making computer products. The IBM/Canon team effort is therefore intended to open a new dimension for business growth on both sides.

Virtually all American and Japanese semiconductor companies have created such alliances in one form or another. In the area of flash memories (a new type of semiconductor memory chip that may eventually replace magnetic disks as storage devices), Intel is contributing its designs and semiconductor technology and Sharp its semiconductor process and manufacturing capacity. Motorola is trading aspects of its microprocessor technology for access to Toshiba's technology in DRAMs. Several teams have formed to develop both



**DESPITE THE LANGUAGE AND CULTURAL
GAPS, U.S. MANAGEMENT MUST LEARN TO
BE MORE COMFORTABLE IN JAPAN,
WORKING WITH THE JAPANESE
INSTEAD OF AGAINST THEM.**

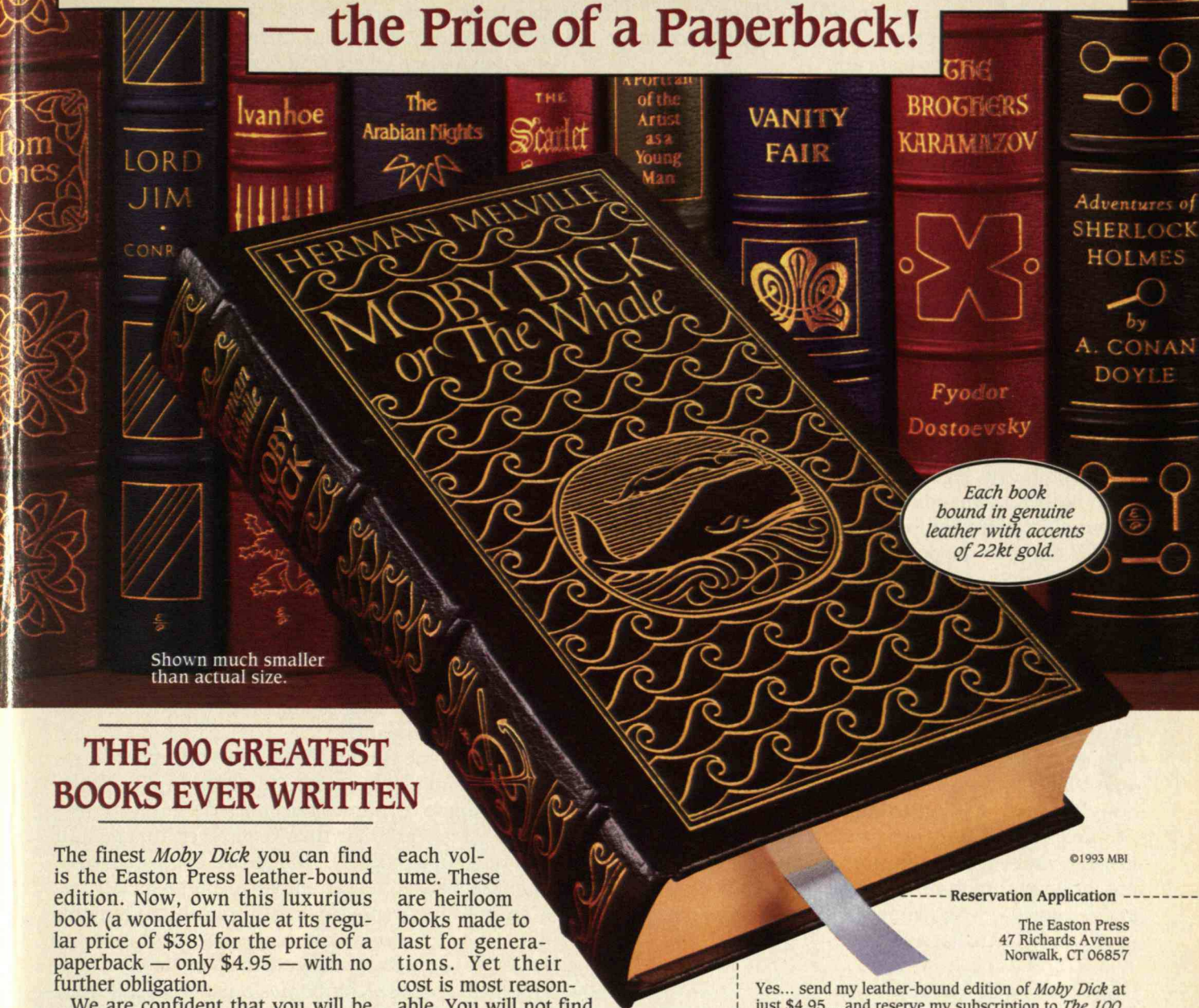
designs and processes for future-generation DRAMs: NEC and AT&T Microelectronics; Texas Instruments and Hitachi; and IBM, Toshiba, and Siemens. These partnerships are already reporting progress. For example, Texas Instruments and Hitachi announced last September that they had completed the design phase of their 64M DRAM and had begun developing a volume-production prototype, to be finished by spring 1993. (This next-generation memory can store 4 times as much information as the 16M DRAM, which is just beginning to reach production, and 16 times as much as today's commonly used 4M DRAM.)

In addition to their technological advantages, these alliances are heavily motivated by financial factors.

The cost of developing the chip design and manufacturing process, and the capital investment required to build a fabrication line for each successive generation of DRAMs, are each now approaching \$1 billion. No company can now afford to make such investments on its own, given the high level of risk: the DRAM market is exceedingly competitive, with major U.S., Japanese, Korean, and Taiwanese suppliers all fighting for market share. And because prices of new-generation products typically drop precipitously within a few years, only the first one or two vendors to market have any chance of making significant returns on the enormous investments. Since these market dynamics are not likely to change in the near future, it is probable that DRAM makers will be collaborating on product and process development for some time to come.

U.S. and Japanese companies are also working together at the fuzzy boundary that (less and less) separates computers from consumer electronics. The Japanese giants that dominate the consumer-electronics industry—Matsushita, Sony, Sharp, and others—have relatively little experience making computers. For their part, Western computer companies are not knowledgeable about the consumer-electronics business. Because it seems clear that future consumer-electronics products

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
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will have a large computer content, and that computer products will have to become more "consumerized" to gain widespread acceptance, U.S. and Japanese companies have now begun to team up.

Apple Computer joined forces with Sharp in 1992 to develop, manufacture, and distribute pocket-sized "personal digital assistants"—devices for managing telephone numbers, schedules, memos, and other personal information. Apple, with its extremely successful user-friendly interfaces, will provide the software, while Sharp provides LCD technology as well as expertise in consumer-oriented design and marketing. AT&T, meanwhile, is working with several Japanese companies, including Matsushita, NEC, and Toshiba, to develop palmtop and pocket machines incorporating Hobbit, an AT&T microprocessor specifically addressing small multimedia applications. AT&T hopes to develop a consortium of companies dedicated to using Hobbit for their personal computing products.

For some time, high-definition television (HDTV) has been hailed as the next big boom for Japanese consumer-electronics companies. But bringing the cost of HDTV down to the point where consumers can afford to buy the products has proven difficult. One problem is in decoding HDTV broadcast signals into the data needed to display images on the TV screen. The first-generation design to accomplish this task included some 150 separate chips. Hitachi, Sony, Fujitsu, and Texas Instruments have jointly developed a second-generation set of only 30 chips, requiring less than half the power of the earlier design. The four companies divided up the work: Fujitsu developed digital signal processing chips, Sony designed analog-to-digital processors, Hitachi produced a voice-output processing chip, and Texas Instruments developed the frame memory chip (for storing individual picture "frames," or images). Toshiba and Motorola, who teamed up for the same purpose, have also reported success.

Don't Wait for Government

American and Japanese companies have clearly come to believe that cooperation is essential. The question is therefore not *whether* to collaborate but how to do so successfully. While the Japanese have long been adept at meeting their objectives in such partnerships, it is too soon to tell if American managers have truly learned their lesson—whether they will have the vision, discipline, and tenacity to achieve the goals of their alliances with Japanese companies.

The most important element of success will be attitude. U.S. managers need to change their views of Japan, beginning with the inflammatory rhetoric so common in some circles. Rather than regarding Japan as a foreign country harboring corporate enemies, Americans could

think of it much as they think of California—a place with a large market, world-class companies, leading-edge technology, and some different ways of doing things, but a place where Midwesterners, say, have no trouble conducting business. Despite the language and cultural gaps, which are substantial, U.S. management must learn to be more comfortable in Japan, working *with* the Japanese instead of against them.

This means, first of all, coming to Japan. Though top executives from many Western companies still carefully avoid such travel, this is not true of those who have built successful alliances with Japanese counterparts. Bob Palmer of Digital, Scott McNealy of Sun Microsystems, Bill Gates of Microsoft, and John Scully of Apple are all frequent visitors to Japan, meeting with executives of partner and potential-partner companies to develop the personal relationships so critical to business success in that country. Only by being in Japan can U.S. management truly understand the opportunities, risks, and business practices in the Japanese market.

Second, Western managers cannot wait for governments to untangle the various U.S./Japan trade issues—such as closed *keiretsu* business practices and Japan's impenetrable and byzantine distribution system—that receive so much attention. Many of these problems are real, and government must help solve them. In the meantime, leadership falls to the private sector. This means U.S. executives must seize the initiative, taking an aggressive stance in establishing beneficial relationships with Japanese companies.

Third, the time is now. The worldwide recession is having a particularly severe impact in Japan. Many major Japanese corporations reported significant revenue declines, and their first losses ever, for the half year ending September 30, 1992. Some companies have announced plans to reduce employment, financial markets are moribund, and capital is extremely tight. In this climate, many Japanese companies are more anxious than ever to cooperate with Western companies.

Finally, American companies must recognize that such alliances will not substitute for developing their own strengths. This means maintaining core capabilities separate from the alliances and acquiring new methods, skills, and technologies that can then be used whether or not the marriages last.

If the marriages do last, the opportunities for U.S. and Japanese partners could be enormous. The formerly underdeveloped countries of Asia are booming; Latin America is picking up speed. The newly opened countries of Eastern Europe and the former USSR, as well as much of the continent of Africa, are in need of responsible economic development. In these regions, as well as in already industrialized nations, U.S. and Japanese companies could play major roles if they act in concert. ■



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COVER:
William Loftis is a collaborator on Sharon Daniel's "interactive sculpture" involving four participants—two visitors and two performers. Loftis is wearing headgear equipped with a video camera and attached to a tricycle on which he is sitting. The power of his pedalling controls the display of images and sounds originating in parts of the sculpture attached to each of the participants. A \$2,000 Council for the Arts grant supported part of Daniel's costs in creating the piece, which she says is about "heightened awareness of perceptions." She is a lecturer in the Visual Arts Program in the Department of Architecture and had help from MIT students over IAP. At the time she took this photo the piece was still under construction.

DESIGN FLAWS IN DEPARTMENTAL PRIORITIES

David Andrew's article (*TR, February/March, p. MIT 7*) describing my retirement symposium superbly captured the role hands-on engineering design education has played in the MIT Mechanical Engineering Department. Practices started here in the 1950s are now employed worldwide in universities and even reach down into the secondary and elementary schools. Students thus engaged go beyond the personal challenge and thrill of design-build-test to understand what engineering is all about and what fulfillment a career in engineering can bring. At the same time, they better appreciate how important it is to master the sciences that underly engineering.

Andrew's article describes an esteemed tradition which I believe is threatened in the very crucible in which it arose. This past academic year, several faculty who have figured most prominently in devising and directing required undergraduate subjects in mechanical engineering, 2.70: Introduction to Design and 2.73: Design Projects, and our graduate design subject, 2.737: Designing Smart Machines, have been denied tenure or promotion and have either left MIT or know they must leave soon. And I, who mentored design faculty here and elsewhere, do not see in our remaining ranks nor in prospective hires the talent, the will, and the courage to take on strenuous, resource-consuming design teaching.

These administrative decisions belie the protestation of support promised by the MIT colloquium on "Teaching in a Research University." I find it ironic that the paeans for the present activity are coupled with the rejection of those who so ably implemented it.

ROBERT W. MANN, '50
Whitaker Professor Emeritus
of Biomedical Engineering

TIME TO SURVEY THE CUSTOMERS

I would like to comment on the five-year degree program adopted by EECS (*TR,*

February/March, p. MIT 3). As a 1981 graduate of the department, I am wondering if MIT academicians have had any contact recently with their "customers"—that is, the alumni/ae they spent four years or so teaching.

Though I may be in the minority, it is my opinion that the textbook knowledge I acquired as a student is not overwhelmingly applicable to my former career as an Air Force pilot or my present work as a small-business consultant. I have not used calculus, complex variables, or numerical analysis even once in the last 10 years.

I do value my education highly. What I value, however, is not the ability to solve differential equations but the ability to solve problems—any problems—an ability that MIT excels at teaching. The subject matter is a side issue.

Like in any business, MIT should pay close attention to its customers, past and present. If the administration has asked alumni/ae what they think of their education and its value to their current careers, I would like to read about it. If such a survey has not been conducted, I think it's overdue.

DAVE MCCLELLAND, '81
Duluth, Ga.

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A Different Take on Technology Transfer

With little fanfare, a unique program has flourished at MIT since the early 1970s, offering a year of professional development to people from the front lines of community problem-solving.

The Community Fellows program annually enrolls between 12 and 14 community organizers, teachers, and staff from public and non-profit agencies. Some come from Indian reservations, some work in depressed urban areas, and others serve rural communities; they come from as far away as Alaska and as nearby as Cambridgeport. While their goals are quite different from those of most MIT students, their year at the Institute enables them to develop valuable tools to apply to their community work, much the way alumni/ae carry extensive skills and experience into their private-sector careers.

More than 200 fellows have graduated from the program since it was founded in 1971 by Mel King, now an adjunct professor in the Department of Urban Studies and Planning and a community leader in Boston's South End. King had a vision of harnessing MIT's high powered educational resources for the good of poor communities. "I had watched people at MIT develop techniques that they turned into competitive advantages," says King. "I thought that people who were involved with human beings—the most important aspect of our lives—could spend some time [at MIT] researching and developing techniques that would make a difference in their communities."

Within the last decade, the program's emphasis has shifted from what King describes as broad issues of "racism, gender oppression, and class oppression" to a specific focus on working with youth. King selects fellows from a pool of applicants, looking for participants who are well supported by their

employers and home communities and whose goals match MIT's resources.

Fellows are based in the Urban Studies and Planning Department, but they typically rove through the Institute to find what they need; some also take courses at Harvard. Each fellow designs his or her own objectives, and all take King's course on "Issues and Strategies in Community Development" and participate in program seminars. Their tuition and living expenses are funded in part by their employers with help from private foundations. (The Ford and Kellogg Foundations have made long-term funding commitments to the program.)

Before she became a 1992–93 fellow, Susan Richards says she had always felt that MIT was remote, even though she lived and worked for most of her life within a mile of the campus. "I was very intimidated when the year first began."

A veteran of seven years as a teacher at the Community Arts Center in Cambridge, Richards wanted to use interactive video to document the projects that her teenage students had completed over the years. But when she first walked into MIT's Media Lab, she was overwhelmed. "Those rooms looked like Star Trek—the dim lights, the huge computer screens. I'm not a computer person." Mel King introduced Richards to associate professor of media technology Glo-

rianna Davenport, who agreed to take her on as an independent study student.

"Susan has an incredible insight into her community, something very few of us have anymore," says Davenport, who had worked with several community fellows prior to Richards. "And she has a real passion for the content [of the art produced by her students], which you need to make a media project work."

Richards envisions a videodisc system that combines photos of art projects and of the students who created them, as well as interviews and longitudinal profiles of the young artists, all cross-referenced by a variety of themes. She intends to have the system housed at the Arts Center and available to students, parents, and others interested in the data and images. Such a documentation process strengthens a community's sense of itself, Richards believes, and also helps the young artists perceive themselves as the producers of something valuable.

Richards' first challenge is "expanding her technical skill to the level where she can really use the technology to do what she wants," says Davenport, who echoes King's view that the fellows program allows MIT to serve an important public interest. "MIT is very good at technology transfer at the corporate level. Doing it for communities that aren't as wealthy as corporations is a really interesting feat."

Angie Searcy, a 1992–93 fellow from the Dorchester section of Boston, came to MIT hoping to design programs to help teen girls who get into trouble. Her main qualification: personal experience. Before cleaning up her own life, Searcy says, "I lived all the issues [of troubled adolescence]—teen pregnancy, drugs, violence, all that was my life growing up."

"Today I see it happening all over again with young women, and I want to try to cut 'em off at the pass, let them know there's more out here for them," says Searcy, who turned her life around and now volunteers at the Dorchester Youth Center. Her goal for the year is to acquire skills that will help her design





and raise funds for an intensive workshop for girls at risk. She's learning to write grant proposals in a writing course taught by faculty member Louise Dunlap, and over the winter she visited a model youth-development center in Albuquerque.

With little academic grounding, Searcy says "everything I'm doing here is a first. In the beginning, I was so intimidated I used to go home and cry. But the program is like a big family, so I got the encouragement I needed. Now if I don't know something, I feel it's okay to ask. They'll break it down. If I still don't get it, they'll break it down even further."

The fellows not only provide each other with support and opportunities for learning, the group also affords a context in which to test and develop ideas about working with teenagers. "When I went out there, I had some ideas about why some kids from difficult circumstances become successful in work or college, while most of their peers do not," said 1990-91 fellow Delroy Calhoun, coordinator of a job- and college-preparation program for low-income teens in Minneapolis. "I had some inkling that personal relationships, mentorships, had a lot to do with it. Being around the people in the fellows program, discussing their experiences working with youth, really helped solidify that idea."

Calhoun took that lesson home. "The Community Fellows Program helped give us the perspective of people around the country who are dealing with issues that are similar to those we are facing," says Jim Storm, executive director of the Loring-Nicollet Bethlehem Community Centers and Calhoun's boss. Having a staff member serve as a community fellow "broadened our horizons," Storm says.

Upon his return to Minneapolis, Calhoun developed a program in which high school students work as tutor-mentors to junior high school students. The program has been so successful that the junior high schoolers have decided to become tutor-

mentors to elementary school students. And Calhoun has been asked to help shape policy for the Minneapolis Youth Trust, a major funder of local youth employment and training programs. □ — *JIM HIGHT is a freelance writer and the coordinator of United Youth of Boston, a community newspaper for teens.*

Low-Level Waste Redux

For years, radioactive waste disposal at MIT meant little more than tossing contaminated equipment or leftover isotopes into the proper containers. Safety, not volume, was the issue, but no longer. Since January 1, only one landfill in the United States will accept low-level radioactive waste from Massachusetts, and even that facility's days are numbered. MIT researchers are feeling the pinch.

"It does make us think twice about using radioactive isotopes and what happens when we're finished with them," says Peter Dedon, assistant professor of toxicology.

Dedon regularly uses tritium, an isotope of hydrogen, to peek inside cells under attack by anticancer drugs or other toxic chemicals, hoping to see how the chemicals damage DNA. But now, instead of covering a lab bench with disposable plastic-backed paper before every experiment, he uses a plastic sheet that can be wiped clean with a paper towel, a simple shift that cuts the volume of radioactive waste in his lab by 90 percent.

Thanks to similar waste-reduction efforts campuswide, the Institute produced just 17 barrels of low-level radioactive waste (LLRW) in 1992. That's a far cry from the 500 or more filled annually a decade ago. MIT managed that dramatic reduction—during a period when research use of radioactive compounds actually grew—through common sense and vigilance, says Fran-

cis Massé, the Institute radiation protection officer.

Following an intense training program, researchers and students no longer stock up on large quantities of tritium, carbon-14, or phosphorus-32, for example; they now order just enough for a particular experiment. They no longer dump non-radioactive packaging into the specially marked waste containers. Many labs are switching from disposable rags and lab coats to washable versions. And a pilot project begun in January aims to cut the waste stream further by promoting still more careful separating of radioactive and non-radioactive material and the use of washable equipment whenever possible. January also saw the introduction of quarterly, computerized reviews of the low-level waste generated by each lab. Massé says that staff members will even open waste containers and analyze the contents to see what might be kept out in the future.

MIT has been responding to something of a "crisis" in LLRW disposal that has been smoldering for years. By the late 1970s, only three sites—Barnwell, S.C., Beatty, Nev., and Hanford, Wash.—were licensed to accept such material. To ensure that these states didn't become permanent dumping grounds for the whole nation, Congress passed the Low-Level Radioactive Waste Policy Act in 1980 and beefed it up with some get-tough amendments in 1985. These require every state to either build its own disposal site by 1993 or band together with a few neighboring states to build one.

As of New Year's Day, the Nevada site closed, and Hanford stopped accepting waste from all but the eight members of the Northwest "compact." Barnwell still takes waste from any state, but it is scheduled to close for good after June 1994. Since Massachusetts, one of the few states to go it alone, is just beginning what could be a five-to-eight-year process of siting and developing a safe landfill, generators of LLRW will have

to provide temporary storage on site after that date. The door is still open for the Commonwealth to join a compact, but Massé is prepared to handle the Institute's storage requirements for more than 20 years if necessary.

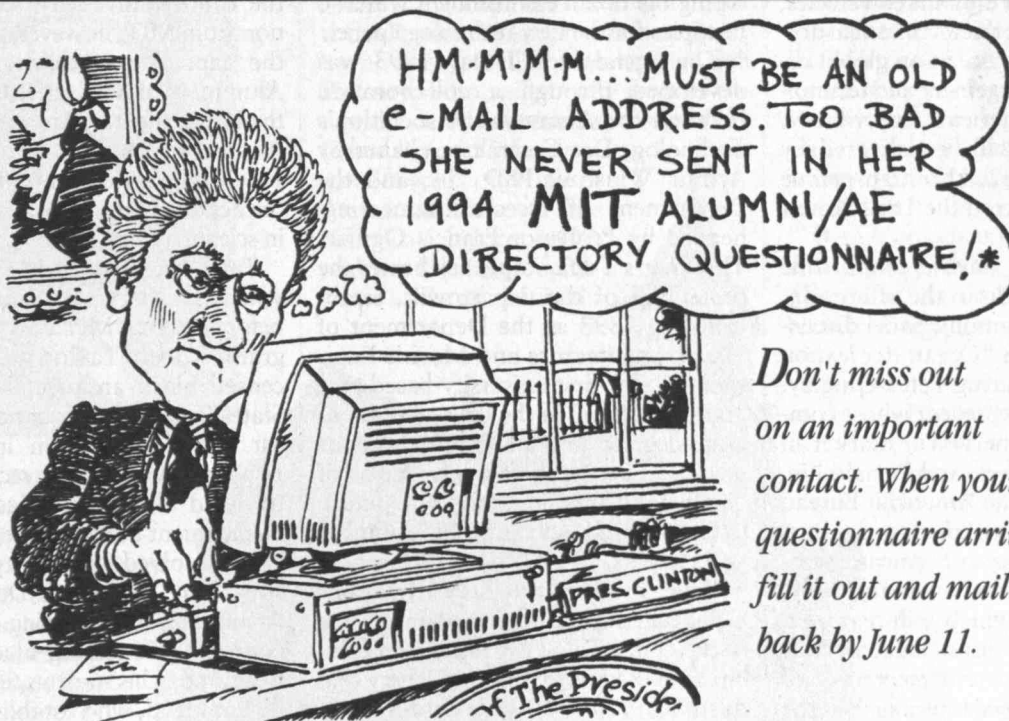
In theory, up to a dozen dumps could be operating by 2000, which "just doesn't make sense," says Massé, a member of Massachusetts' Low-Level Radioactive Waste Management Board. The Barnwell and Hanford landfills have enough space to accept waste through the middle of the 21st century, he says, and a 1989 federal study projects a substantial drop in the waste stream nationwide. Massé believes there won't be enough waste to financially support more than a handful of sites. At Barnwell, for example, the current rate for disposing of a 55-gallon drum is

about \$3,000. Nebraska, as host state for the Central Interstate compact, estimates it will receive only a fraction of Barnwell's annual traffic and will thus need to charge \$15,000 per drum.

A Supreme Court decision in June 1992 "pulled the teeth out of the 1985 amendments," prompting states to drag their feet, says Martin Gelfand, research director for the Washington, D.C.-based Safe Energy Communication Council. The court struck down a controversial provision that would have forced any state without access to a disposal site by 1996 to take full legal responsibility for every curie of low-level radioactive waste generated within its borders, even that produced by industry. This decision may focus attention on the real source of the problem. "Why should states and taxpayers pay for new disposal sites

when it is the nuclear power industry that generates virtually all of the waste?" Gelfand asks. (The Department of Energy estimates that roughly 80 percent of the volume and 97 percent of the radioactivity comes from the nuclear power industry.)

Foot dragging could actually be the wisest course right now. Last year, warnings of a declining waste volume and too many sites moved the U.S. Senate to reopen the issue. Given the uncertain political climate, no state wants to be the first to approve a new radioactive waste landfill, says Massé. If Congress were to change the law and call for one or two suitable locations for all states to use—which Massé considers a sensible idea—any state already building a dump would likely be considered a front runner for the honor. □ — P.J. SKERRETT



Don't miss out on an important contact. When your questionnaire arrives, fill it out and mail it back by June 11.

** Just kidding of course. Even the President can't get a copy of the Directory, he's not an MIT grad!*



ALUM- NEWS

T-Day 1993: Research Over, Under, and In the Briny Deep

Technology Day '93, entitled *Riding the Wave of Innovation: The Ocean and MIT*, will take a provocative and comprehensive look at the ocean and its uses—scientific, commercial, and recreational. It will raise questions we face today, and those our descendants will face tomorrow—the role the oceans play in climate and weather, monitoring ocean-born pollutants, the marine environment as a potential site for waste disposal, and tapping the mineral and biological wealth of the seas.

Getting under way in Kresge Auditorium on Friday, June 4, the showcase morning lectures will focus on exploring the ocean with unmanned vehicles, high-tech developments in measurement, effects of the ocean on global climate, and the management and technology behind an America's Cup victory. The last lecture will be delivered by William Koch, '62, the high-profile skipper who garnered the 1992 America's Cup.

Alumni/ae may have a tough time deciding what to do in the afternoon, having to choose among panel discussions ranging from "Ocean Recreation and Sports," featuring Peter Quigley, '85, the young entrepreneur whose company dominates the world market in masts for windsurfers, and Donald Liu, '66, senior VP of the American Bureau of Shipping, who will discuss the burgeoning popularity of tourist submarines(!), to "New Naval and Maritime Missions," which will feature a talk by Professor John Deutch, '61, recently appointed undersecretary of defense. Controversial topics such as the efficacy of double hulls will be tackled by a panel on "Oil Spill Issues," which

will include Epaminondas Embiricos, '64, chair of a London-based shipping company, Admiral William Kime, NE '64, commandant of the U.S. Coast Guard, and Lissa Martinez, '76, a consulting marine engineer.

Rounding out the afternoon will be a panel on new ocean technologies that highlights the work of faculty in the Department of Ocean Engineering. Single-purpose autonomous underwater vehicles (AUVs), for example, have been around for a number of years, but the new state of the art involves more flexible and intelligent craft, able to sense their surroundings and make decisions while their missions are underway. Professor C. Chrysostomidis will share news of recent successful tests in Antarctica of an AUV designed to reach depths of 20,000 feet. His vehicle performed well, and at a fraction of the cost of comparable work done by other labs. Innovations in acoustics for underwater communication and new sensors for measuring the ocean environment will also be topics for the new-technology panel.

The agenda for T-Day 1993 was developed through a collaboration between the Alumni/ae Association's Technology Day Committee, chaired by Arthur Winston, PhD '54, and the Department of Ocean Engineering, headed by Professor Francis Ogilvie. This year's T-Day topic celebrates the centennial of the department, established in 1893 as the Department of Naval Architecture and Marine Engineering—the first university-based program of its kind in the United States to grant degrees. Graduates of the department are expected to swell the ranks of quinquennial reunion-goers who return to Cambridge for a variety of Alumni/ae Week events.

Other traditional T-Day attractions include a luncheon and announcements of class gifts. There will also be an exhibition in the Hart Nautical Gallery that documents the 100-year evolution of Course XIII via photographs and samples of ocean engineering technology—

such as a prototype AUV—and a windup reception featuring a replica of the America's Cup.

Alumni/ae who have not yet registered for Technology Day should check in with the Alumni/ae Association reunion group at 617/253-8233. □

—SHERIE SAINT JOHN

BAMIT Celebrates 100 Years of Black Achievement

Robert R. Taylor, Class of 1892, was a man whose personal modesty and subsequent career as a college administrator obscured his architectural achievements until decades after his death. A grandniece once said that he was "too busy helping humanity to heap up records about himself." Ambitious plans under way to celebrate the 100th anniversary* of his graduation from MIT, however, promise to fill the gap. The organization of Black Alumni/ae of MIT (BAMIT) is joining the Department of Architecture and the Alumni/ae Association in marking the year with a series of events celebrating the achievements of African-Americans in science and technology.

Taylor was born in 1868 and worked with his father, a building contractor, before entering MIT's architecture program. Robert Taylor was the first licensed black architect in the United States, and after graduation he worked for an all-white firm in Cleveland. Booker T. Washington recruited Taylor to head the Mechanical Industries Department at the Tuskegee Institute, which evolved, under Taylor's leadership, into Tuskegee's Department of Architecture and Planning. Several of the country's pioneering black architects were among his students, including John A. Lankford, who established the first known black professional architectural office in 1899.

Many of the original wood and brick buildings of the Tuskegee campus were designed by Taylor and built by students, down to and including the bricks themselves. A speaker at the 1907 dedication of Taylor's Tantum Hall noted that "254 students learned seven different building trades" while erecting the building. Taylor designed buildings throughout the South, including Booker T. Washington's house, "The Oaks," and the Duke University Chapel, but many were recognized as his work only recently.

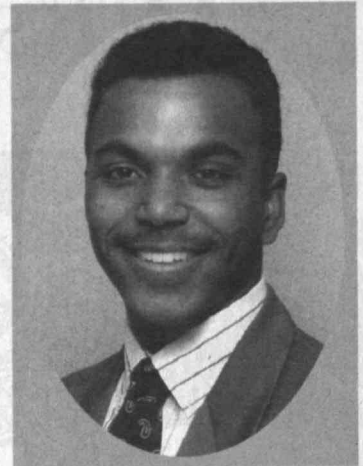
Architectural historian Ellen Weiss of Tulane University, who has published papers on Taylor's works, commented that the recent surge in multiculturalism has renewed interest in black architecture in America.

Darian C. Hendricks, '89, the president of BAMIT and one of the prime movers of the Taylor centennial, says that the occasion offers a valuable

opportunity to raise the public information level. "People assume that blacks weren't a presence in higher education before the civil rights movement of the 1960s," Hendricks says. "But black students have been at MIT since 30 years after the Civil War." Given MIT's worldwide reputation, highlighting the presence and achievements of blacks at MIT automatically conveys the message that blacks are successful in science and technology. "When you say MIT," Hendricks remarked, "you don't need to debate qualifications."

The centennial events will get under way on May 27 when Derek Walcott, the West Indian poet and Boston University faculty member who recently won a Nobel Prize for Literature, will share his poetry at BAMIT's annual Commencement reception for black students and their parents.

Later the same week, as part of Reunions, BAMIT will offer a Saturday program on "Navigating Through Time: Black Explorers from Columbus to the Present." Many black "voyagers" have been invited, including Bill Pinkney, who sailed solo around the world; Ivan van Sertima, author of *They Came Before Columbus*, a major study of people of African descent in the Americas before 1492; and the five black astronauts. Cheryl McNair,



BAMIT President Darian C. Hendricks, '89

widow of *Challenger* astronaut Ronald E. McNair, '77, will also speak.

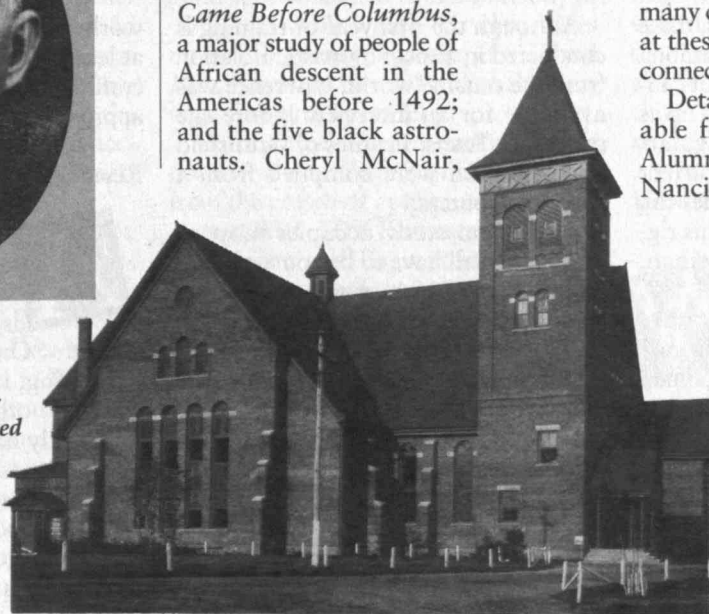
The School of Architecture has scheduled a symposium for September 10-11 to celebrate black architects. Events will include a multi-media exhibition of the works of black architects, including Taylor, from the turn of the century to the present, and a panel discussion with deans of architecture at historically black colleges and their Ivy League peers.

The Department of Architecture wants to develop relationships with colleagues at black colleges as part of an effort to attract African-American students to MIT for graduate study. Hendricks is quick to point out that in many cases, MIT alumni on the faculties at these schools have already initiated a connection.

Details on centennial events are available from Charles Bradley, '83, and Alumni/ae Association staff member Nancie Barber at (617) 253-8217. □



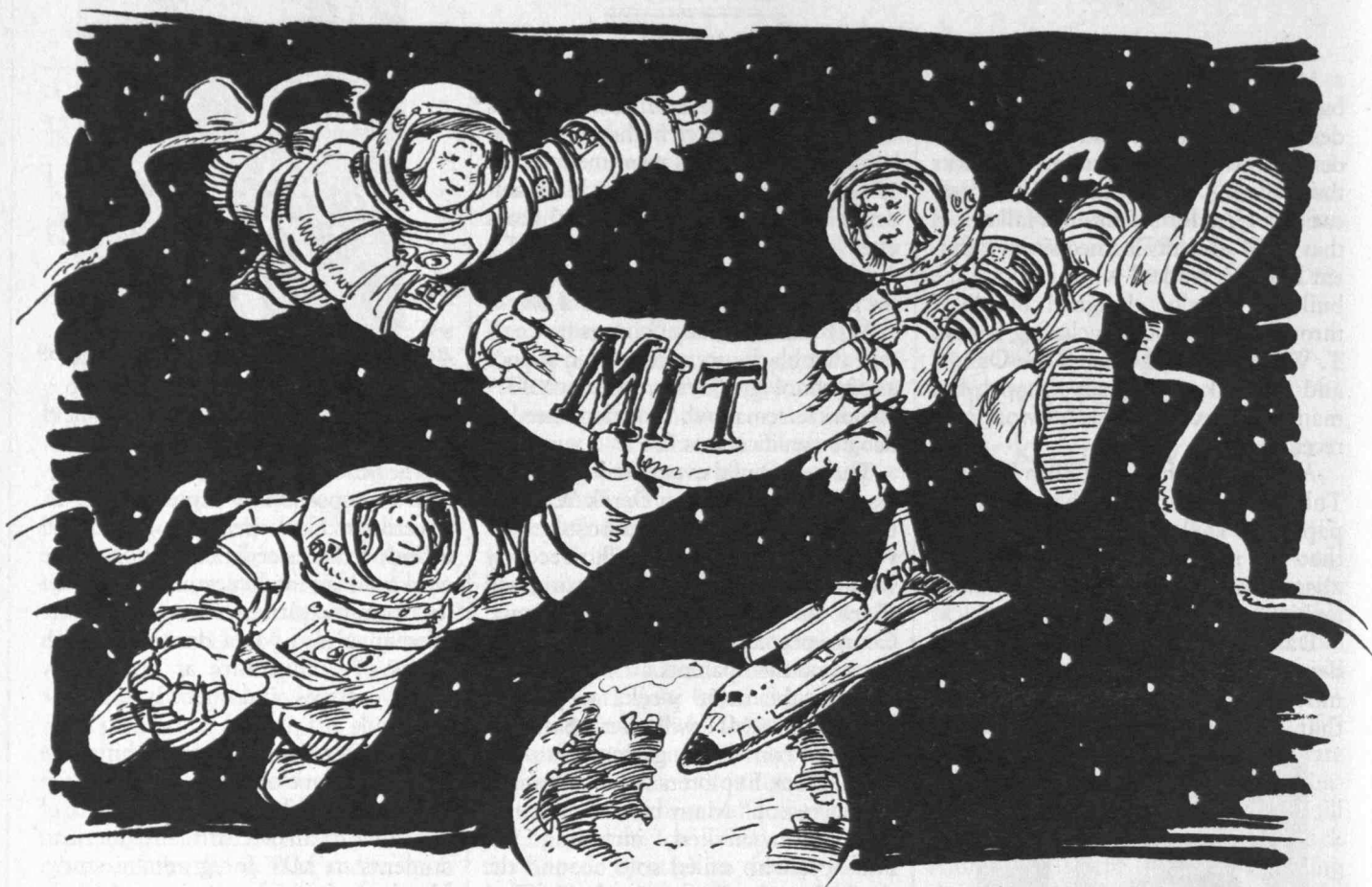
Robert R. Taylor, Class of 1892, was the first licensed African-American architect. He designed many of the buildings on the campus of the Tuskegee Institute, including the Chapel, the first electrified building in the country.



—ROBERT DIMMICK (*The author is a freelance writer and administrative assistant to the Alumni/ae Association executive vice-president. *Dimmick notes that a precedent for celebrating a centennial 101 years after the event was set by the Columbian Exposition of 1893, which celebrated the 400th anniversary of Columbus' arrival in America in 1492.*)

MIT'S THREE HIGH-FLYERS

By Jennifer C. Reynolds



Deep in the heart of Texas, three MIT degree holders are among the new crop of astronaut candidates. MIT alums turn up as astronauts with some regularity, but one thing that makes the current class exceptional is that it includes the first MIT women to qualify for this rigorous adventure. Catherine Coleman, '83, and Wendy Lawrence, SM '88, along with John Grunsfeld, '80, were among the 19 chosen by NASA, from a field of 2,400 applicants, to be groomed as mission specialists.

The class also includes, for the first time ever, international candidates—two each from Europe, Canada, and Japan. After a year of “basic training,” successful candidates will receive an assignment for a specific space-shuttle mission, and they can expect to venture into space around the middle of the decade.

Although the first year of training is conducted in almost monastic isolation from the outside world, Lawrence was available for an interview before she moved to Texas. Profiles of Grunsfeld and Coleman were compiled from a variety of sources.

Classroom study occupies most of their time—all have to be conversant in astronomy, NASA programs, shuttle hardware and experiments, and of course, operation of the shuttle itself. Occasional field trips punctuate the routine: The astronauts-in-waiting will take parachute training in Florida, practice survival skills in Seattle, and journey to all NASA centers and major contractor sites around the country. “It’s a lot of hard work,” says NASA spokesperson Barbara Schwartz. “They’re busy every single day of the week.” One training event sure looks more like fun than

work, however—each class experiences at least one flight in the KC135, an aircraft that can offer its passengers a close approximation of weightlessness.

Research Chemist Cum Volleyball

Ask any number of people who know her what Catherine (Cady) Coleman is like, and you get a single answer: “Once she sets her sights on something, it’s very hard to persuade her to do otherwise,” says her father. “All Cady has ever needed to achieve something is someone telling her she couldn’t do it,” her mother reports. And a former professor recalls that being “extremely goal-oriented” was her most outstanding quality.

Coleman was born in 1960 in Charleston, S.C., into a military fam-

ily—her father worked in diving and salvage in the Navy. In the late '60s, back when astronauts were also aquanauts, James Coleman helped construct Sealab, an underwater research facility used by astronaut Scott Carpenter. Their father's work made the space program a vivid reality for Coleman and her siblings. And like many women who are high achievers, she had a mother who "always told me I could do anything I wanted to," Coleman said in a previously published interview. But it was an experience at MIT that gave her ambition final form. "When Sally Ride (the first female astronaut) talked to us, it really got me feeling that I had a chance."

Coleman arrived at MIT on a ROTC scholarship and earned a bachelor's degree in chemistry. While at MIT, she played flute in a jazz group, and among her other skills she speaks French and Norwegian. (Sorry, no Klingon.) Commissioned as a second lieutenant in the Air Force, she embarked on graduate work at the University of Massachusetts, specializing in polymer synthesis and surface modification. In 1988, Coleman began her active duty at Wright-Patterson Air Force Base in Dayton, Ohio, where she completed the work for which she was awarded a doctorate in polymer science and engineering by UMass in 1991.

As a Air Force research chemist, Capt. Coleman synthesized organic polymers for potential applications in such areas as optical switching and high-density data storage. At the time of her NASA selection, she was working in Wright-Patterson's Aeronautical Systems Division, where she was responsible for developing new materials for next-generation avionics and computer systems and directed contractors producing high-strength polymer film for aircraft parts and electronic components.

A willing volunteer when test subjects were needed at Wright-Patterson, Cole-



CATHERINE COLEMAN, '83

man participated in physiological studies on spatial disorientation and gravity-tolerance, helping test new night-vision helmets and G-suits and setting endurance and tolerance records in the process. Her good sportsmanship comes in handy at NASA as well, where her classmates reportedly elected Coleman, at 5'2" and 100 pounds, to be the "volleyball" during a zero-gravity exercise.

Coleman believes her background in polymer chemistry helped her stand out from the crowd of applicants. Professor August Witt, TDK Professor of Materials Science and Engineering at MIT, agrees. "The space program needs good, solid scientists and participation from a broader spectrum of scientists. Without a science base, it's extremely difficult to make a reliable prediction of how something will behave when lacking gravity. Cady and other recognized scientists chosen by NASA can help the nation."

It seems likely that her skills in human relations helped in her selection as well, as there's no room on a cramped shuttle for personality conflict. "I like to think of myself as a 'people person,' and I

think that will help in being a good astronaut," she says, a view that is backed up by her erstwhile lab partner, Laura Kiesling. When the women first met, Kiesling had been hesitant about working with Coleman. Could someone she describes as having "a vibrant personality—so funny," Kiesling wondered, also be an asset in the lab? Now Kiesling believes that "if anyone can, Cady can restore people's confidence in the space program." That seems like asking a lot, but communicating with the public is something astronauts do a lot of.

When the time came for Coleman to move to Houston, she and her mother, Anne Doty of Westerly, R.I., drove down together in Coleman's Mazda RX7 convertible. "We took four days and called it our own 'Thelma and Louise' trip," says Doty. During her five-year tour with NASA, Coleman hopes to fly on several shuttle missions and has said she'd like to be chosen for duty on Space Station Freedom, a two-year commitment. Of course, even that assignment won't save her from the ubiquitous Grandmother Syndrome. Doty is hoping that her daughter, along with everything else, will marry and produce a grandchild. "Even if the baby is born in space, that's fine with me!" she says.

How to Be an Astronaut in Seven Steps

Wendy Lawrence, a 33-year-old lieutenant commander in the U.S. Navy, plans to take the concept of cross-training to new heights. On land, she runs marathons and rides her bike. On water, she rows. In space, she hopes to do some walking.

Lawrence has spent her entire life planning for this latest turn of events. "I grew up with a fascination for airplanes," the daughter and granddaughter of naval aviators remembers. "Deep down inside there was something that

A childhood diet of science fiction and sugary cereals apparently is no hindrance to achievement.

always attracted me to aviation."

She was a baby when her father was in test-pilot school with space pioneers Scott, Glenn, and Carpenter in Florida. Although a heart murmur disqualified the senior Lawrence from space travel, he became involved in the selection process for the original astronauts in the late 1950s and early 60s. Growing up down the street from astronauts made the job less remote to his daughter.

She was 10 years old when Neil Armstrong stepped onto the moon. Now she, along with a million other kids, *really* wanted to be an astronaut. Over time and with advice from her father, Lawrence mapped out the strategy designed to make her a "must have" for NASA: Attend the U.S. Naval Academy. Become an aviator. Get physically fit and stay fit. Study a relevant subject. Get operational experience with the Navy. Earn a graduate degree. Teach.

The first class of women enrolled at the U.S. Naval Academy when Lawrence was a senior in high school, but she did have the distinction of being the first woman to serve as deputy commander for the 4,400-member Brigade of Midshipmen before she graduated in 1981. She had considered taking her Academy degree in oceanography, but her father suggested that a technical degree would serve her plan more than science. So she majored in ocean engineering.

Convinced that piloting helicopters offered the best opportunities for women, she spent five years at sea as a pilot on a utility helicopter. Then in 1986, the Navy offered to address the next item on her checklist. "They asked me if I wanted to go to MIT for a master's degree in ocean engineering. They would pay tuition and salary, and all they wanted was another four years of my life," she recounts incredulously. "I



WENDY LAWRENCE, SM '88

couldn't sign fast enough."

At MIT, Lawrence focused on acoustic tomography, using long-range sound propagation to detect and analyze ocean circulation. "We can analyze how long it takes a sound wave to travel a certain distance," she explains. "As ocean temperatures change, the travel speed of sound changes as well. Using math computations, we can come up with a weather map of the ocean for surface vessels and submarines." The Navy is deeply invested in this research, which Lawrence notes also "may be used to detect whether the ocean is in fact getting warmer, shedding some light on the question of global warming."

Lawrence spent three summers living in Woods Hole. "I was watching tourists take boats to Martha's Vineyard and Nantucket while I spent hours indoors sitting in front of a computer screen," she laughs ruefully. "I split my time between Woods Hole and MIT. I lived in an apartment by Fresh Pond Reservoir, and since I hated commuting on the T, I rode my bike. In the winter, when the bike paths were too snowy, I kept

my pilot skills finely honed on Mass. Ave, dodging cars doors and competing for space."

While at MIT, Lawrence was involved in Campus Crusade for Christ and also rowed with the graduate women's crew club. "We rowed from 5:30 to 7 a.m. I did that for one year before I said 'I really need my sleep.'"

Lawrence, then a midshipman at Annapolis, was among the crowd running the Boston Marathon in 1978. It was her first 26-miler and not a promising moment in her running career. "I was on antibiotics for a bad sinus infection, and the race wiped me out for a couple of months; that was a stupid mistake." But she was bitten by the running bug nevertheless. It has been a constant in her adult life;

no matter where she is, she runs. "I used to run on the cargo deck at sea. You're enclosed in the ship, on steel decks. You've got huge boxes of material that are up against the wall, you're on a non-skid surface but it's oily from the forklifts' hydraulic fluid, it smells like diesel fuel, and the ship is pitching."

Operating off a small island near Oman during one cruise, Lawrence and the other chopper pilots flew in to meet Air Force cargo planes, then transferred supplies out to the ship. Waiting for the planes to arrive, Lawrence would change from flight suit to shorts and T-shirt and run on the tarmac. "It was so nice to run outside in the fresh air that I didn't mind that every time I turned I was looking at a sand dune and eight camels."

In 1990, Lawrence was tapped to teach physics back at Annapolis, thus reaching the end of her countdown for NASA qualification. During the months that her application was being considered, she continued teaching, running, coaching women's crew, hoping.

The space program called in March 1992 with the good news. Her father, a vice-admiral who is now a faculty mem-

*Some people stumble
into their careers through a series of happy accidents,
but not these astronauts.*

ber at the Academy, told her that since the Navy has a tradition of holding "Tiger Cruises," in which spouses and children are taken out for a day at sea, he wants Wendy to arrange a Tiger Cruise for him on the space shuttle. Guests on the shuttle are very unlikely, but Lawrence does have a new list of goals that should be more achievable. "I want to walk in space," she says matter-of-factly. "And I'd love to go to the moon.

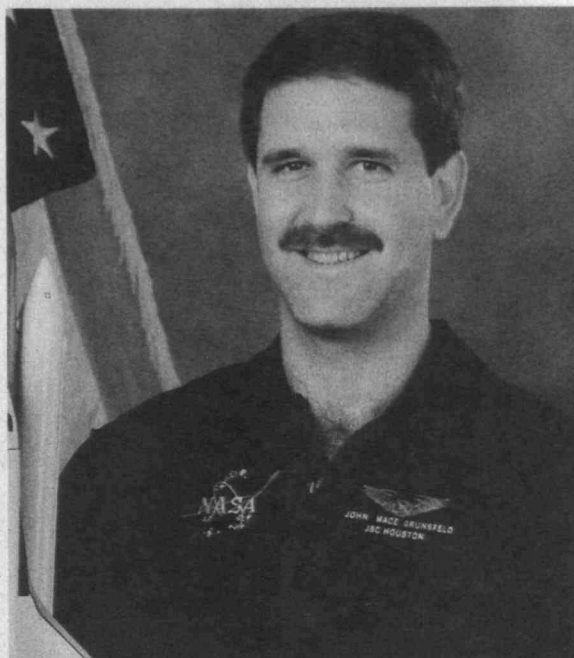
MIT Physics Degree is the Ticket

When John Grunsfeld started reading science fiction as a child, he asked his mother, "Where is this school called mitt? All the scientists seem to go there." "Funny you should ask," replied Sally Grunsfeld, "because that's where your father went to college." Crestfallen, the boy wanted to know why his father, Ernest (Tony) Grunsfeld, '52, was an architect rather than a physicist.

As an eight-year-old in third grade, he knew he wanted to be an astronaut, and his parents report that even then, he acted on his ambition. "We live on a series of ravines, and this is where John would 'practice' being an astronaut," his mother says. "He would take ropes and things, climb around the ravines, and pretend."

Early on, Grunsfeld's mother tried to use his astronaut goal as a way to shape his behavior. "All John ate when he was little was cereal," she recalls, "and maybe peanut butter. So I said to him, 'John, suppose you become an astronaut and you walk around on the moon. When reporters ask me what I'm going to serve you when you get back, how can I possibly tell them Crispy Critters and Captain Crunch?'" The ploy didn't work. "He still eats those things," she admits.

Like his sci-fi heroes, Grunsfeld



JOHN M. GRUNSFELD, '80

intended to prepare for his career in space by studying physics at MIT. He knew he'd have to be at the top of his class, so he put himself on a high-school regimen of four hours of study every night. Once he had the MIT degree under his belt, he moved to Japan, where he served as a visiting scientist at the University of Tokyo/Institute of Space and Astronautical Science in 1980-81. Back on his native soil, he earned a PhD in physics from the University of Chicago in 1988. He was a senior research fellow at the California Institute of Technology when he was notified that his dream of 25 years was about to come true.

According to Barbara Hill Thornton, '80, a housemate at the #6 Club (Delta Psi) at MIT, Grunsfeld had a single-minded career focus but not a one-track mind. "He was on the tennis and ski teams at college, and he drove a fast VW Scirocco and competed in road rallies," she reports. "He loved the Chicago Symphony and always studied to the Brandenburg Concertos. In fact, he inspired me to buy my first classical music: a

boxed set of Beethoven symphonies conducted by Solti. In John's mind that was the best investment I could make."

During Grunsfeld's freshman year, he worked as a night operator for the Center for Space Research's SAS3 satellite. "He would go on the graveyard shift to monitor radio beeps from space," Thornton says, "which sounds boring but it really wasn't, because you could actually hear space. John always wanted to be a mission specialist, and since he wasn't a military type, he figured physics was the best way to accomplish his goal."

A specialist in gamma-ray and X-ray astrophysics, Grunsfeld has conducted a wide range of astronomical observations, focusing on compact objects within our own

galaxy, the galactic center, high-energy cosmic rays, and solar flares. He was a co-principal investigator on an experiment that employs instruments on the Compton Gamma Ray Observatory, launched by the space shuttle in 1991.

Grunsfeld's father was pleased but not surprised his son was accepted to be an astronaut. NASA has a pattern of selecting people who are multi-disciplined beyond academia, Tony Grunsfeld says, "and John fits the bill. He is a pilot and flies his own plane for recreation. He's an ice climber and a mountain climber. In fact, he and his wife, Carol, went ice-climbing in Bolivia on their honeymoon. He's always been a risk-taker, and I'm sure NASA liked this aspect of his personality."

The lesson for parents: a childhood diet of science fiction and sugary cereals is surely not a necessary—or sufficient—background for high achievement, but evidently it's not a hindrance either. □

—JENNIFER REYNOLDS is a freelance writer who first met an MIT-educated astronaut while working on a profile of Wendy Lawrence for Runner's World.



One of projects funded through the MIT Council for the Arts Grants Program was a 1992 Student Workshop production, in Spanish, of Punto F., a play by Guillermo Preciado Falcon,

Putting Their Money Where Their Hearts Are

FOUR HOURS. That's all the time it took for the members of the Grants Committee of the Council for the Arts at MIT to spend \$8,735.50. And they had a good time doing it.

BY DEBRA CASH

The council has come a long way since the days when Catherine Stratton, hoping to beautify the expanse of unadorned walls at the President's House, formed a handful of philanthropically minded MIT graduates into an "art committee" to advise her as she turned the residence into an ever-changing public gallery. That was during the administration of her husband, Julius A. Stratton, '23, 1959-66.

Early in the decade of his presidency (1971-80), Jerome Wiesner extended the range of the committee's charter and helped it grow into a more stable volunteer organization of alumni, alumnae, and friends dedicated to nurturing the visual, literary, and performing arts at the Institute. Wiesner's support for the arts was one of the defining aspects of his administration, and the Grants Committee was one of the council activities launched on his watch. Since 1974, the committee has funded nearly 800 projects by students, staff, and faculty—working individually or in groups—with awards ranging from several hundred to several thousand dollars.

Proposals are solicited and reviewed on a quarterly basis, and last December eight committee members gathered to consider an equal number of proposals requesting a total of \$15,635.78. In the morning, applicants pitched their


projects—screening videos, showing samples of their art work, and playing taped music.

Long-time Grants Committee chair Bradford Endicott, '49, (who admits that as an undergraduate his extra-curricular enthusiasms ran more to the current affairs radio show "Town Meeting of the Air" than to high culture) calls these personal encounters with students the "best part" of being a member of the committee. "We're not just outsiders who sit down with problems on paper," he explains. "We get direct contact with the applicants and their all-important enthusiasm."

"I want us to help [applicants] get away from tunnel vision wherever it occurs," Endicott says. "There are fads among scientists and engineers as well as among artists. I believe in promoting the idea of training yourself to do your own thinking, of taking everything with a grain of salt." Head of the committee for eight years, Endicott steers this meeting like sea captain, moving easily between the forthright, brook-no-foolishness opinions of Peggy Lamson and effervescent quips from Toni Wyman.

The Council for the Arts—and this standing committee—represent significant wealth, and the grants budget is made up entirely of donations from members. Mark Palmgren, council director, says that while annual gifts range from \$50 to \$50,000, the average is about \$4,000. (The Grants Committee is only one among a number of avenues through which the Council for the Arts supports arts-related activities, facilities, purchases, and co-curricular programs at MIT.)

"It's a remarkable, collegial group," says James Plaut, "and a fascinating intellectual experience." Plaut, who has



'92 (in beret). Preciado Falcon, shown here with members of the cast, co-founded a theatre group in his native Mexico before coming to MIT, and Punto F. was his second full length play under the pen name Bernal Quijade.

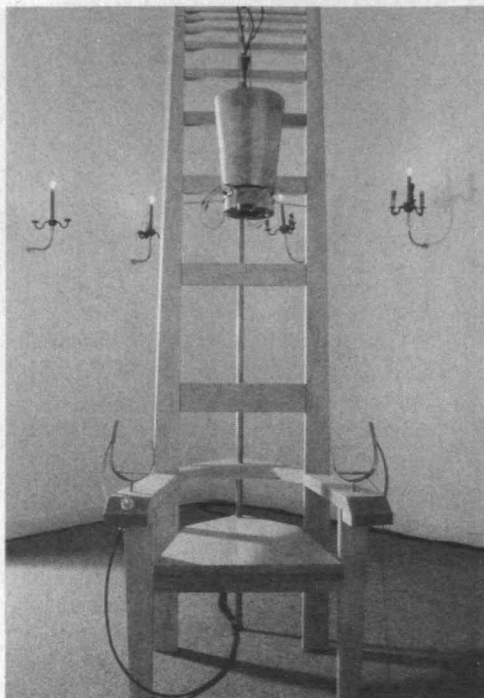
The program enriches campus life by funding everything from Indian classical dance to lighting-design software.

served on the boards of a number of New England cultural institutions, including Boston's Institute for Contemporary Art and the New England Aquarium, points out that there is a difference between being a member of this committee and serving as a museum trustee. "The best trustees [at museums] trust the director and his or her staff to do the work and do not interfere with the daily life of the institution, even though they are ultimately accountable. On fine-arts advisory boards at universities, you [typically] monitor the work going on in [academic] departments. The MIT council is unique. The fun of being on the Grants Committee is our ability to look into what's going on and have an insight into the creative ferment of the arts."

Some applications receive easy, unanimous votes of support. Herbert Glantz, '52, president of a company specializing in neon and industrial lighting, speaks with something close to awe as he describes a "mind-boggling" project entitled "Retinal Poetry: A Visual Language for the Blind." The artist is Elizabeth Goldring, director of exhibits and projects for MIT's Center for Advanced Visual Studies (CAVS). Goldring, who is sight-impaired herself, will be developing an interactive computer system that compresses nouns and verbs, making each word into a "pictogram" that can be used as a building block for writing poetry. The pictograms will be beamed directly onto her retina through a scanning laser ophthalmoscope—an instrument usually used by a physician to examine the interior of the eye, particularly the retina.

Goldring's \$3,300 grant is earmarked for technical and programming support, and "is exactly the kind of fusion of art and technology we're looking for," Toni Wyman commented with satisfaction. Down the road, the project may lead to an installation geared to sighted and vision-impaired visitors.

Other projects generated more com-



When spectator-participants are seated and attached to this chair in an installation by lecturer Sharon Daniel, their heartbeats control video and audio displays from four separate sources. The photo on the cover of this section shows another element of the same interactive sculpture.

plicated discussions. The December round included a request from the campus a cappella singing group, the "Chorallaries." They wanted to make a recording on CD, which would be expensive, and in considering the proposal, the committee members drew as much on their business acumen as on their enthusiasm for music. In this spirited discussion, as well as the others throughout the afternoon, they kept returning to one central concern: what ingredients ensure that the arts thrive—here or anywhere else? In the end, the committee awarded the Chorallaries \$3,250 of the \$4,100 requested to fund studio time, and it offered a number of suggestions as to where the rest of the

money might come from.

Other projects funded during 1992–93 include a student-sponsored performance of classical Indian dance, a faculty member's exhibition of architectural drawings and models, screening of Egyptian films by a staff member, and a recital by pianist Kyle Hoepner, an MIT Affiliated Artist. Poetry readings, a Latino theater performance, computer software to improve the lighting designs for student dramatic productions, the 1993 Collegiate Jazz Festival (held on the MIT campus in April), a student-written and-directed film, and an exhibition of Cibachrome photographs—these projects and more also received support this year.

That rich array notwithstanding, Palmgren has noted a sharp drop in applications from previous years. Some of this can be attributed to changes in certain programs, such as fewer students enrolled in CAVS and more support for graduate-student projects in film and video through faculty research grants. Other reasons behind the small number of applications are unexplained, but Palmgren is trying to reverse the trend with measures such as offering an IAP session on the application process and announcing application deadlines over the Athena computer network.

Palmgren is convinced that the program, small as it is, is important to the vitality of the campus, and John Kunstader, '49, agrees. "It's difficult to divide intellectual activity into little blocks and call one box science, one box art, and another the humanities," says Kunstader, who is Council for the Arts chair and a Grants Committee member. "It seems to me that knowledge is universal, and in a sense, the really good scientists and engineers are highly creative people. This creativity can be expanded by exposure to all the creative activities of humankind. It sounds grand, but it's true." □

—DEBRA CASH is a Technology Review contributing writer.

If We Just Raised All that Money, How Come We've Got a Budget Gap?

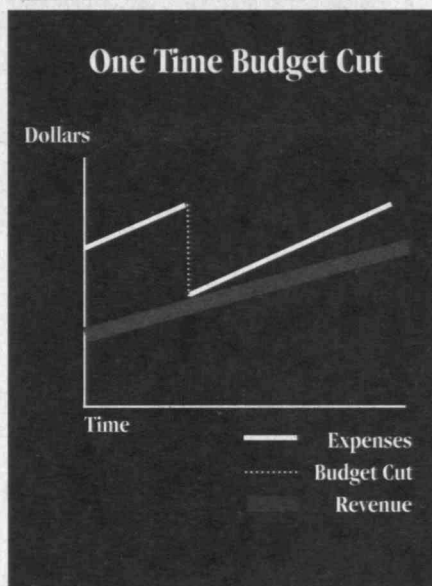
You could say that MIT President Charles Vest has one advantage over U.S. President Bill Clinton. Clinton heads an economy that's seriously underperforming, and he's expected to take steps to restore its former strength at the same time he's cutting spending. Vest, on the other hand, heads an institution still tops in its field—most recently acknowledged in the *U.S. News* ranking of research universities—and he “merely” has to trim his deficit without disabling the features of the place that make it first rate.

Any comparison between MIT's budget problems and those of the nation may well go beyond the limits of credulity, but it's not a bad idea to introduce a discussion of Institute finances with a nod in the direction of Washington. The federal budget crunch is the eye of the needle through which every thread of university funding passes sooner or later.

Funding is the number-one worry in post-secondary education, with financial problems driving an estimated 57 percent of U.S. colleges and universities to announce mid-year budget cuts in 1991-92. MIT is still relatively strong, but far from immune to budget problems.

In fact, it's been clear since summer 1992 that MIT's “operating gap”—the difference between revenue and expenditure that has to be made up from unrestricted gifts, reserves, and discretionary funds—has been growing. Dealing with actual budget numbers—money spent or received—is hard enough: every figure has to be defined and qualified. Dealing with projected budgets, however, is chaos in action: change one estimate and the whole house of cards changes shape. But any way the administration looked at it, MIT was heading for trouble: a gap for FY93 projected at \$16 million, up from \$13 million in FY92 and \$9.3 in FY91. The spectre for FY94 was an operating gap approaching \$20 million, a threat that made it imperative to change direction.

Observers have noted that \$20 million is a small fraction of a budget of more than a billion. But as Provost Mark Wrighton has pointed out, \$20 million approximates, for example, the total FY93 base budgets of the Departments of Physics and Mathematics. And it is a large fraction, he says, of the only component of its income stream that MIT controls: tuition, which accounted for only



\$170 million of the budget this year.

MIT is covering its deficits. But to do so, it has had to apply nearly \$50 million in discretionary funds to meet current needs over the past four years. That's money that the financial planners would prefer to apply to preserving the purchasing power of endowment income over the long term.

With none of the external factors that underlie the deficits expected to improve in the foreseeable future, it is up to MIT to come to grips with the problem. For months, the administration has been at work, identifying priorities and potential savings—dealing with the specifics of the FY94 budget while trying to set in motion long-term changes. Wrighton emphasizes that one-time budget cuts are not sufficient. A one-time cut only slows deficit growth (see chart). What's needed, he says, is a series of steps that will bring growth in expenditure down to match growth in revenue and keep it there.

In reports to the community, Wrighton outlined the priorities that govern the deliberations: a commitment to excellence in science and technology, limits on growth in tuition and the self-help requirement, preservation of need-blind admissions, salaries com-

petitive with peer institutions, sufficient flexibility to support educational innovation and experimentation, and faculty development (opportunities to hire young faculty, undiminished support for the hiring of more women and minorities, and hardening of salaries—that is, making them less dependent on research contracts).

Staying within those parameters, \$5 million had been cut from the projected gap for FY94 as of late March, and the process is not over. The steps MIT has taken: implementing budget reductions totalling \$3.5 million; reallocating \$2.4 million to general funds from other accounts; reducing the number of faculty openings across the Institute by 14; halting the practice of allowing departments to retain the difference between the salaries and benefits of a retiring full professor and a newly hired assistant professor; limiting new hires to the assistant professor level unless there is special budget provision for a senior appointment; and raising tuition by \$1,000. As Wrighton says, “these first steps . . . will prove to be easier than subsequent steps.”

None of the reasons behind the operating deficit are news to alumni/ae who have been reading the papers or this magazine. With the economy in trouble, industry is cautious in contracting for research and in financially supporting innovative academic programs; potential donors have less discretionary income; endowment income is no longer growing at the rates it did through the '80s; and financially strapped families of students need more financial aid.

Financial aid has actually been clobbered from two sides. First, a larger proportion of students need help than did decade ago, and the gap between their resources and the cost of an MIT education—the “need” MIT must meet—is growing. The problem has been compounded over the same time period by the federal government's dramatic withdrawal from undergraduate support. As a result, MIT has been required to contribute a higher and higher proportion of the total bill from general funds, over and above its endowment income designated for scholarships. In 1988, MIT awarded \$12.4 million in undergraduate financial aid, of which \$7 million came from general funds. When the books are closed on FY93 at the end of June, MIT expects to have awarded

Projecting a \$20-million operating gap, MIT is looking for long-term savings to change the budget profile

a total of \$25 million in aid, of which \$16 million will be from Institute funds. That's an increase in dollars from general funds of more than 100 percent over five years.

As serious as the economy (and more profound in the long run) is the impact that the end of the Cold War and the declining military budget is having on research spending in the United States, particularly at MIT. David Litster, vice-president and dean for research, believes that the reverberations of the changed world military threat will go far beyond the Pentagon budget. Research revenue grew steadily in the Reagan-Bush years, and the Department of Defense was the largest single research contractor at MIT. Now only 15 percent of on-campus research is DoD sponsored, and the budget at Lincoln Lab declined from a high of \$440 million in 1990 to \$380 million in FY92, with more cuts to come.

But it's also vital to recognize, says Litster,



writing in a publication of the National Research Council and in *Tech Talk*, that concern over national security was the engine that also drove much of research sponsored by the Atomic Energy Commission, the Department of Energy, NASA, and NSF. With the fear of superpower conflict replaced by other concerns, he predicts that research priorities will experience even greater upheaval.

At the same time that DoD is cutting back, the federal government commitment to pay both the direct and indirect cost of its sponsored research, essentially in effect since WWII, is threatened both in Congress and in the White House Office of Management and Budget (OMB). After more than a year

of deliberations, OMB issued draft revisions of circular A-21 (guidelines governing university grants and contracts) shortly before the change in administration. Although it's clear that universities will have to absorb more of the costs related to research, Vest told the faculty that he and fellow presidents of research universities support the main thrust of the revisions: to simplify, clarify, and bring consistency to the guidelines.

But MIT took strong exception to two of the new guidelines: the first (and more important) relates to tuition for graduate student research assistants (RAs); the second is a proposed 26-percent cap on indirect administrative costs while at the same time disallowing some of the administrative costs that MIT has been billing directly to contracts.

MIT and a handful of its fellow research universities have been dealing with RA tuition as an employee benefit, and the revised A-21 makes it a direct cost of research. At MIT, that would push the already-high contract cost of hiring a graduate student from \$35,000 to \$55,000. Since it is unlikely that either research sponsors or MIT itself would be able to come up with the \$10-\$12 million to maintain the current level of annual support for graduate students, the rule is expected to result in a decline in the number of RAs in favor of hiring post-docs. That amounts to eating our seed corn.

The universities affected have persuaded OMB to allow time for planning by delaying the effective date of change until October 1997. The final guidelines had not been issued as of March, and MIT and its peers are also hoping that the final draft will provide for a one-time conversion to new rules on RA tuition, rather than an administratively unmanageable "transition period," as now proposed.

MIT and other elite research universities have taken a beating in the media of late, and the fact that tuitions have been rising so much faster than the cost of living—and median income—in the decade of the '80s stirs the most ire. The universities are getting the message. For example, Princeton, like MIT, announced a tuition for next year that includes the smallest percentage increase in more than 20 years. (Princeton went up 5.9 percent; MIT only 5.6.) MIT, Princeton and other universities have stated policies of holding tuition increases down. □

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CLASS NOTES

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I hope Enos Curtin reads our class notes this month because his friend, Charles Elliott Lane, Jr., has submitted the following limerick about Enos, who attained the age of 98 on December 29, 1992. We know Enos' many friends—not just classmates—have similar thoughts on his behalf.

*There's a merry young blade of 98
Who says that "Life is just great"
With him I agree
And wish it were me.
Wonder if 'twill ever be?*

—Don Severance, acting secretary, 39 Hampshire Rd., Wellesley, MA 02181

18

In the last month of the year I send New Year's greetings to our classmates. The reply to my request from Herb Larner is in my judgment of interest to all MIT alumni/ae—and is therefore being printed in full. All I can say is that it makes you feel you are living in the Copley Square and Cambridge of MIT 50 years and more ago. Isn't it great to do that right now? Thanks to Herb Larner.

"Dear Max:

"It is easy to deal with your request for a story about MIT and events that stand out in my memory. I was born in Cambridge and played games on the very spot known as Kilian Court. Hundreds of nickels I spent on car fare to classes in Boston. The school was a mere 50 years old when I matriculated there. Massachusetts Institute of Technology seemed too grand a name for a couple of small buildings on Boylston Street and three one-story structures with glass roofs near the Back Bay station. People called the place Boston Tech. The longer name was a tongue-twister, and one day while I was exiting from a chemistry class in Walker Building, a husky driver of an Adams Express truck with a carboy of chemical reagent to deliver stopped me and asked, 'Say kid, is this the Massachusetts Ingenuity of Technology?'

"When time came for the move to Cambridge, I was one of a few students chosen to escort valuable pieces of sensitive equipment there. Countless times I crossed the Harvard Bridge piloting a huge Peerless truck. But MIT was not welcomed to Cambridge with enthusiasm by everyone. Harvard and Radcliffe were tax-free burdens in the mind of one member of the Board of Aldermen. [He] said in a speech one night, 'That piece of land the New Technology wants to buy is the best piece of land that was ever born and if I'm elected mayor of Cambridge and the people need more learning I'll put readin' literature down in the Shelter.' The Shelter was a dilapidated shack, a hangout for the denizens of the alderman's political home. That was 1916, and Boston Tech had now been given a new identity and was now

ensconced in an elegant, imposing edifice. So let's call this story 'The Metamorphosis of Boston Tech.'

"Two years later, 1918, you and I became MIT alumni. World War I was raging. Uncle Sam was in control of our lives, and it was a long time before I got back to Cambridge. I guess it must have been for the mid-century Convocation (1949). MIT had grown but not to the point where it had an auditorium worthy of the great occasion. Boston Garden, where boxing matches were held, was needed for the Main Event. There one June night I had a ring-side seat. Where tuxedo clad announcers [usually] intoned the names, weights, and home towns of exponents of 'the art of modified murder,' as noted sports writer Grantland Rice once called boxing, I listened

"Say kid, is this the Massachusetts Ingenuity of Technology?"

to MIT's world famous guest of honor, one of the greatest fighters of his or any other time, Winston Churchill, discourse on the subject of world affairs. A few feet away in another ring-side seat sat Mrs. Winston Churchill, listening to her famous husband.

"My next memorable event was a fund-raising affair at the Waldorf-Astoria in New York. Host Alfred P. Sloan picked up the tab for 2,500 dinners for MIT alumni living in the New York area. Karl Compton was MIT's president at the time and was, of course, the featured speaker. His subject was education, and he told a story about his sister, who was the wife of a missionary in India. She had hired a native electrician to wire the house. The man seemed unsure of himself and frequently interrupted the lady with questions of what to do next. Finally she told him, 'For goodness sake, you are the expert. Use your common sense,' to which the native replied, 'Madam, common sense is a rare and precious gift of God. All I have is a technical education.'

"It was many years later before I had a chance to thank Mr. Sloan for the dinner. That was at the Beau Rivage in Switzerland, on the shore of Lake Geneva. He invited Mildred and me to tea in his suite one afternoon. There for about two hours he talked about Boston Tech in the 1890s and the things he

learned that helped him in later years when he created General Motors. As we were saying goodbye, I reminded him of that night at the Waldorf and Dr. Compton's story of his sister and the workman who had a good technical education but had been shortchanged in the matter of common sense. We had another good laugh about it.

"My last visit to MIT was our 50th Reunion, almost 25 years ago, and I can only imagine what MIT looks like today. I suspect that it takes in most of the area between the River Charles and Lafayette Square. Much water has gone under the bridge since I left Cambridge. Down here on Chesapeake's Eastern Shore all is calm and quiet. Sometimes it seems that I'm back in the 19th century. I watch a flock of Canada geese honking to each other in the sky. But then, five miles above, I hear an airplane droning on its way to New Orleans, London, or Paris maybe. I pick up the morning's mail, and the date on the *New York Times* reads January 4, 1993, the start of a new year. I remember that I had my 99th birthday last November and that I'm living in my 100th year. The 21st century isn't too far away, and I wonder what it would be like to reach that point in life.

"Then I look at my 1918 diploma hanging on the wall, and I say to myself, 'MIT, you're 129 years old and all grown up.' Then I say to Boston Tech, 'You've come a long way, baby, and may the Lord bless and keep you going forever.'"—Max Seltzer, secretary, North Hill, Apt. B403, 865 Central Ave., Needham, MA 02192

19

This is income tax season and we are behind in our *Review* notes but perhaps better late than never. We talked with Barbera and Don Way and found them well and glad to exchange a few words. I am sure if you are a classmate they would love to hear from you at 846 Cedar Terrace in Westfield, NJ 07090.

We then called Doc Flynn and spoke with him and his wife, Erma. We found Erma feeling well and glad for our call. We learned that Doc was in the hospital for a tumor operation on his colon. He is home now and recuperating nicely though we had to cut the talk back because the phone was noisy. We would ask some 1919 readers to send Doc and Erma a letter which I am sure will be appreciated: Dr. and Mrs. Edmund Flynn, 203 So. Third St., Leighton, PA 18235.

Regards to you all.—Bill Langille, secretary, Box 144, Gladstone, NJ 07934

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Please send news for this column to: Harold Bugbee, secretary, 313 Country Club Heights, Woburn, MA 01801

21

Maxine (Mrs. C.H.) Clarke of Brielle, N.J., died on February 1, 1993, at home. She and Cac had recently celebrated their 64th anniversary. Loving wife and mother, we shall miss her. She went to all of our five-year reunions including the 70th in 1991 when she and Cac were the only ones from our class to attend. She did a lot of painting as a member of the Manasquan River Group of Artists, and memorial donations may be sent to them at P.O. Box 614, Manasquan, NJ 08736.

Cac reports talking to Alex Howes recently. Alex is well, living nearby Cac.

Your secretary phoned Helen St. Laurent in Manchester, Conn., but unfortunately Helen could not hear. Helen put her companion on the phone so I was able to identify myself.—

Sumner Hayward, secretary, Wellspring House, E64, Washington Ave. Ext., Albany, NY 12203; Samuel Lunden, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

22

It is with regret your secretary must let you know of the death of our classmate, George W. Dakin, on November 15, 1992. George spent his working life in the oil refinery and lumber businesses.

He left a wife, two sons, eight grandchildren and three great-grandchildren. Memorial donations may be made to the American Cancer Society, 23 Central Avenue, Lynn, MA 01901.—Martha Munzer, secretary, 4411 Tradewinds Ave., Lauderdale-By-The-Sea, FL 33308

23 70th Reunion

I have both good news for you and bad. They are somewhat mixed up, read on.

Fred Almquist, who has done a great job as your secretary-treasurer for nearly five years has resigned. The position is open for anyone who will volunteer.

Quite a few years ago it was voted at a class meeting that after all members of the class had passed away the money in the treasury would go to the Institute. As of now we do not have enough money in the treasury to pay the postage on a class mailing. Unless some of you send in your class dues I will have to use some of the "reunion kitty" for class expenses.

Planning to attend the reunion are: Kay and Jay Stratton, Harry Kalker, Mr. and Mrs. Paul Moore, William P. Allis, Mr. and Mrs. Walter Webster, Mary and me, Royal Sterling. Those who may attend are: Cecil H. Green, Mrs. Kalker A. Thomas, and William Upham.

Old age does have its compensations. The luncheon on Technology Day will be gratis to the class—compliments of the Alumni/ae Association.

One of our regular attendees at our reunions was "Doc" Smith. "Doc" passed away on January 24th.

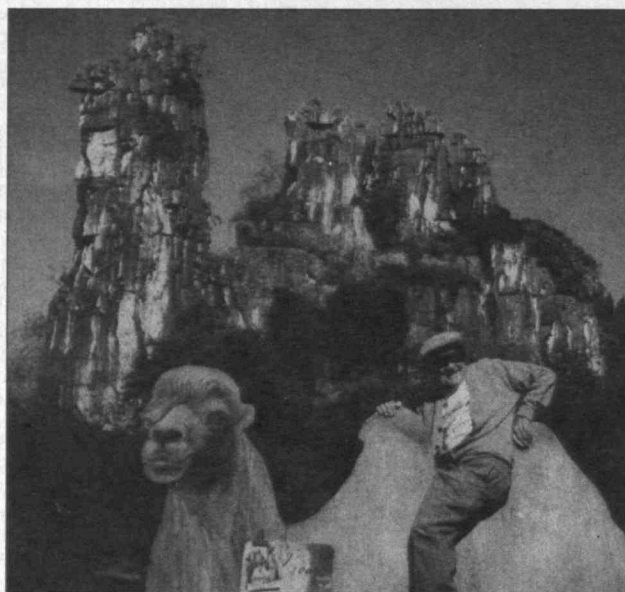
During part of my undergraduate days I was living between Lowell and Lawrence on the

Merrimack River and "brown bagging" it to Cambridge every day. Little did I think at that time that one day I would be wearing *all five hats* of the class of 1923: president, reunion chairman, class agent, secretary, and treasurer.

Send me any news you have (and checks, too) so we can keep this class on the move.—Royal Sterling, secretary-treasurer, Apt. D201, 2350 Indian Creek Blvd. W., Vero Beach, FL 32966-5103

24

A letter from Dick Shea says he had a call from the widow of Philip Cohen. Eileen Shaunesy Cohen, who lives at 100 Memorial Drive, Cambridge, Mass., said that he had passed away on November 30, 1992. I can't do better than quote from Dick's letter. "Phil



Henry Buntschuh, '28, chooses the less rocky camel ride.

was the youngest of three brothers, all of whom graduated from MIT, the first in 1908! I believe this can be a record for successive grads from one family!" I well remember Phil, and of meeting him at our 65th back at the alma mater, and he will be missed. I was looking forward to seeing him again next year. Our condolences to Phil's widow, Eileen.—Co-secretaries: Katty Hereford, Box 5297, Carmel, CA 93921; Col. I. Henry Stern, 2840 S. Ocean, #514, Palm Beach, FL 33480

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Milt Salzman writes that as he approaches his 90th birthday (September 23, 1993), he finds himself slowing down but is in reasonably good health and keeps active. He maintains his own home, sings with a barbershop chorus and his church chancel choir and volunteers in a local nursing home for visually impaired people. Milt has five grandchildren and two great-grandchildren. During the past year he attended the weddings of two grandchildren.

Milt's son Roy, MIT '55, is with Arthur D. Little Co. in Washington, D.C. He recently opened a new vacation and future retirement waterfront home in Rockport, Maine, where Milt spent several weeks last fall. Roy also has a vacation log cabin in the foothills of Green Mountains in Vermont, and Milt hopes to visit either or both this year. He plans to go to the SPEBSQSA convention in Calgary, Canada, in June. Also, Milt hopes to be one of the "survivors" when the 70th Reunion arrives in 1995.—F. Leroy "Doc" Foster, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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It's rather sad when we do not receive notification that a classmate has died until 14 years after his death; however, such is the case. Julio F. Arena of Mexico died January 7, 1979.

William E.P. Doelger of West Palm Beach, Fla., died November 12, 1992. He was the last president of Peter Doelger, Inc., a business started by his grandfather. The business began as a brewing company in the 1850s. Two years after the company was liquidated in 1961, Doelger moved from New York to West Palm Beach. He was a member of the MIT Corporation Development Committee. He was also governor of the New York Real Estate Board, trustee of the Manhattan Savings Bank, and a director of some 10 other endeavors. In Palm Beach, Fla., he served as president of the Norton Museum and treasurer of the Four Arts and of the English speaking union. He was a member of the Bath and Tennis Club and the Everglades Club. He is survived by his second wife, three sons, one daughter, and six grandchildren. His first wife died in 1986.

Please send news to: Donald S. Cunningham, secretary, Eventide,

215 Adams St., Quincy, MA 02169, (617) 328-1840

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Please send news for this column to: Joseph C. Burley, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; Lawrence B. Grew, assistant secretary, 21 Yowago Ave., Branford, CT 06405

28

65th Reunion

While this is being written during a February blizzard for inclusion in the May/June Review and regarding our 65th Reunion June 2-6, possibly to be held during a heat wave, the post-reunion account from your secretary will not appear until October, when the fall foliage may be at its best. Hardly in keeping with the fabulous communication technology of today. Though names of hopeful participants have appeared in this column for many months, it would be difficult at this time to attempt a last-minute summary of any value. But the

reunion will go on and we hope many of you will be there for what will perhaps be our last full-fledged gathering of the exemplary Class of 1928.

Much of the news in our class notes has to do with disabilities and deaths. . . . **Rene Simard** is in a care facility in Ottawa, Canada, after long affliction with Alzheimer's disease. . . . **Everard Lester** is at home in Williamsburg, Va., similarly afflicted. In the November/December 1992 *Review* it was noted that **Homer Adron Burnell** had died on June 26, 1992, and a delayed obituary gave Alzheimer's as the cause. It also reminded us that "Bunny" was active in fund-raising for MIT and was interested in many cultural institutions in Chicago. His lifetime hobby of recreational sports focused on yachting in his later years.

One of our class who has escaped the above disability is **Henry Buntschuh**, who at 91 earned the title of "life of the party" on an MIT Alumni/ae Travel Program tour to China and Hong Kong, as evidenced by a picture of him riding a camel in a scenic setting (see preceding page).

Another delayed obituary is for **Thomas Guile Harvey**, who was mentioned in the April 1993 *Review* as having died November 26, 1992. "Little Joe" retired as a materials engineer for the Naval Avionics Center at Indianapolis, was listed in *Who's Who in Engineering*, and was an Indiana Fellow of the American Society of Metals International. . . . And a final reported loss is the death of **George Henry Flynn** on October 17, 1992, at Tequesta, Fla. We share these bereavements with family and friends.—**Ernest H. Knight**, secretary, Box 98, Raymond, ME 04071; **Hermion S. Swartz**, reunion chair, 12 Minola Rd., Lexington, MA 02173

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Please send news for this column to: **Karnig S. Dinjian**, secretary, P.O. Box 83, Arlington, MA 02174, (617) 643-8364, (603) 926-5363

30

Jack Latham's gift to the Norwich (Conn.) Free Academy, a secondary school from which he graduated, of more than \$1 million to build a science center named for his father **Allen Latham, Sr.**, was reported in last November's Notes. The Latham Science and Information Center was officially dedicated last September with some 30 members of the Latham family attending. The library for the Center was contributed by Mrs. Edwin Land, wife of Jack's Academy classmate **Edwin Land**. Classes had already begun in this new building and both students and faculty are delighted with it. . . . For several years **Win Hartford** taught ninth grade science in a center-city junior high in Charlottesville, N.C., where he developed meaningful talks in which minority students enjoyed taking part. However the junior highs have now been eliminated and he is concerned that emphasis has shifted to superior students. He feels that "if there is any group in urban schools that needs a basic understanding of science, it is our minority students."

Sig Linderoth still plays golf and fixes old

clocks for his friends. He has had an Apple computer for eight years and is now experimenting with an IBM clone. He comments that he is "approaching the doubtful honor of being the oldest member of the Class of '30. However at age 85 he has a long way to go; we have one survivor born in 1901 and three more born in 1903. . . . **Anne and Dave Houston** are building a new house facing Port Royal Sound in the Bay Club of The Cypress on Hilton Head Island. This is "a life-care setup, and eliminates all geriatric worries...has an excellent restaurant where we can eat...when ever we want to...and takes care of all repairs, maintenance, and yard work." The Houstons expected to move into their new home in March 1993.—**Gordon K. Lister**, secretary, 294-B Heritage Village, Southbury, CT 06488

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Please send news for this column to: **Wyman P. Boynton**, secretary, 668 Middle St., Portsmouth, NH 03801

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Rose and Tom Weston send out a newsletter in December to friends and relatives that relates their year activities. It tells of Tom's recovery from heart surgery, their 12-day



Rose and Tom Weston, '32

cruise to the Virgin Islands, and their many other trips throughout the year. They had a particularly interesting adventure in snorkeling. Tom plays bridge three times a week, sings in church choir, and has many civic duties. All this and keeping up with the grandchildren's activities gives them, to say the least, a full life. Tom and Rose, you serve as a model for your classmates.

You may have read the report of the Alumni/ae Association's 1991-1992 Annual Fund raising activities, which detailed \$17.1 million in contributions, \$2 million more than the previous year. It is interesting to note that the Class of 1932 contributed as follows: Our 60th Reunion Class Gift was \$2,400,000; 14 classmates gave through Sustaining Fellows, Founding Life, and Life Members (lifetime giving of \$25,000 or more); 4 classmates gave through President's Fund (annual donors of \$1,000 to \$2,999); 24 classmates gave through Great Dome Associates (annual donors of \$250 to \$999); 34 classmates gave

through gifts of \$100 or more; 3 classmates were volunteer callers for telethons.

The Class of 1932 is listed as having 202 active members. Fifty-seven percent (116) participated in the Alumni/ae Fund. More details of the MIT Alumni/ae Activities for 1991-1992 can be found in the Supplement to *Technology Review* February/March 1993.

Mrs. Ruth Tucker informs us that **F. Curtis Tucker** died after a long illness on November 7, 1992, in Columbus, Ohio. He was the purchasing consultant for General Electric for 25 years. He retired in 1975. In his earlier years he was active in the Nutley Speaker's Club, serving as president during the club's 25th anniversary year. He was active in other professional clubs and civic associations.

I know that many of our classmates have many grandchildren and even several great-grandchildren. I can finally report that I have just become a grandfather for the first time on January 5, 1993. All are doing well. **WRITE—WRITE—SEND PICTURES.**—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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60th Reunion

Our 60th Class Reunion is scheduled June 2-June 6, 1993. Activities generally take place on the campus, with the Class housed by choice either on the campus or at the Sheraton Tara in Danvers (phone: 508-777-2500). You must also call the Alumni/ae Office personnel taking care of all the details. That person is **Ms. Chris Foglia**, Phone: 617-253-8232.

If you follow these very instructions promptly, we may be able to include a copy of your biography (provided you supply it) with the compendium of as many class biographies as we can drag out of you characters. Send it to **Chris**.

I hope no one is foolish enough to delay this matter any further if you have intention of attending, because you ain't going to get much attention after this month. It's going to be a wonderful opportunity, probably the last in our lives, to renew decades-old friendships and to have a

thrilling and sentimental and meaningful experience.—**William B. Klee**, secretary, Box 7725, Hilton Head Island, SC 29938

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Please send news for this column to: **Robert M. Franklin**, secretary, Box 1147, Brewster, MA 02631; **George Bull**, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

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Jackie E. Bonafide, daughter of **Harold H. Everett**, sent a news clipping about Grandparent's Day at Tilton School in Tilton, N.H. Hal and his wife, Florence, attended the celebration with grandson **Chris Bonafide**, who is a freshman at the school. Jackie is director of

communications there. . . . **Lester H. Moffatt** writes from Ft. Worth, Tex., that his wife of 46 years died October 25, 1992. I am sending him the condolence of his former classmates. . . . **Samuel P. Brown** reports from his home on Florida's west coast that Hurricane Andrew spared them the terrible damage it caused on the east coast in South Dade County. Sam and Natalie made their annual trip to the Poconos, stopping to see their families and friends going north in April and south in September.

Frank Phillips, '36 class secretary, sent along a note that his assistant, Jim Patterson, received from Reid Ewing. Reid and Jim roomed together when they both worked at Linde Air Products in Buffalo after graduation. Reid and his wife, Margaret, have moved into the Mayflower Retirement Center in Winter Park, Fla. He says that it is an easy life and quite a pleasant one.

I telephoned a number of '35ers living in San Diego County to produce some news for these notes. . . . **Hamilton H. Dow** and Edith have moved to Lemon Grove, just east of downtown San Diego, and now live in the Monte Vista Lodge. Their immediate problem is trying to compress their furniture from their previous five-room apartment into two rooms. I am ready to help ease the situation if they can decide what they want to keep—my church is having a series of garage sales and I'm on the committee. . . . **John S. Holley** lives with his wife in Chula Vista, which is adjacent to Lemon Grove. He is happily retired but has to take it easy. He had a quadruple artery bypass surgery in 1987 and felt fine for a few years but, like the rest of us, gets tired easily. His doctor told him the bypasses are good for only 7 to 8 years, but I pointed out that must be the average because mine has gone 16, so we're going to keep in close touch.

Morton Rosenbaum and his wife live in San Diego. Mort keeps busy taking care of his garden of orchids. They both spent two weeks in Ireland last year and are leaving for two weeks in Costa Rica and Guatemala this month (February). Mort says that **Karl Achterkirchen**, who lives in Camarillo, north of Los Angeles, has not been feeling well but is hopeful of getting his health back soon. . . . **Sidney Grazi** and Anne live in Carlsbad, Calif., about 15 miles west of Escondido. Before the rain hit us in early January, they played golf regularly on the La Costa Resort course, which had been closed for a full month prior to the PGA tournament. Sid has been president of Home Owners Association for five years and more recently was supervisor of reconstruction of four homes (one his own) that had been sliding slowly down a hillside. It took four years for the developer to arrive at a settlement to pay the association \$4 million for the rebuilding. The Grazis moved out of their home in December 1991 while it was being rebuilt and moved back in December 1992. Sid's latest toy is a computer to play with using Word Perfect and Lotus 123.

In the next issue of the *Review* I will have news about **Chester Bond** and **Louis Pflanz**, among others. Those of you living east of the Rockies, I must rely on your writing to me, please.—**Allan Q. Mowatt**, secretary, 715 N. Broadway #257, Escondido, CA 92025-1880

36

Holiday greetings from classmates came to Pat Patterson, Henry Lippitt, and/or me from opposite sides of the earth—Italy and Hawaii, and from several corners of the 48—New Eng-

land, Florida, Texas, California, etc., but none from members unheard from for 15 years or more. Please, all of you, write a note now—don't wait until next December. Let's hear of some facet of your life or career that stands out in your memory, and/or of some contact with another classmate.

From Italy, Traute and Ken Winsor's greetings were inscribed under a penciled sketch of their home, which Phoebe and I hope to visit this year or next. Their "3-year-old granddaughter in Florida has learned to dial them (14 digits), much to the chagrin of her parents." . . . From Hawaii, a self-designed card of Nilsa and Rob Wead: "From Maui Nei our wishes for a happy holiday." . . . And from Althea and Arnold Kruse at Kula on Maui: "Mele Kalikimaka and best wishes for the New Year. Arnold was 81 November 10."

From Florida, where they were until January, Ruth and Milner Wallace sent an excellent three-generation picture and a poem composed of one line per family member, each line numbered to the photo. Wally wears a beard handsomely. . . . From Jim Schipper in Naples: "Still doing well and able to play golf." . . . Via Henry Lippitt from Vivian and Mal Holcombe, smooching afore a wall-full of photos: "five children and thirteen grandchildren who tend to keep us in touch with reality." . . . Henry forwarded a packet of items with his annual newsletter, in which Ruth told of his mild stroke in April and removal of the ventricular defibrillator (nothing but pain) in November. "He continues weak but his mind is sharp as ever, and he looks forward to resuming his duties and interests." Obviously, Ruth is an upbeat nurse for an upbeat guy. . . . Dottie and Tony Hittl's greetings to Henry told of Yosemite and Oregon in April with daughter Barbara and her husband Hans (visiting from Austria) and a trip to Costa Rica in December.

Jan and Bob Gillette's card to Henry spoke of visiting daughter Deborah in Tiburon and sailing (of course) on adjacent San Francisco Bay. Bob's triple bypass is A-OK and he can ski. . . . Al Horton's wife, Gabriele, reported his 80th birthday December 23. His stroke condition is about the same as when I visited in 1991, but he finds it "somewhat hard to concentrate on reading." . . . Also from California, Margaret and Charlie Price: "We'll be in Santa Fe again at the end of July." . . . From Lucy and Charlie Holman in Texas: "Still enjoy outdoor activities. Won the skeet Veteran World Championship (over age 70) again, so the first time (1986) wasn't a fluke. In 12-gauge event, broke 250 without a miss—oldest ever to do it." . . . From D.C., Bob Walker writes: "Have been busy kicking feathers and pushing chains—managed to spend some time on Outer Banks with daughter Amy and family, and will have Christmas in Oklahoma with son Bob, Jr., and family. Lots of room here in Washington if you come through again." . . . From the Northeast, Karl Gelpke: "I happened on 1935 papers from Testing Materials Lab and wallowed in the nostalgia of those halcyon days. Currently spend some time at Mass General, but at the moment things are under control."

Pat Patterson reports reading one of Eli Grossman's stories for children: "very good." The Pattersons spent Thanksgiving and Christmas with daughter Kathleen and family in Nashua. . . . Larry Peterson has purchased the camp on Great Sacandaga lake that was available only as a rental. He is recovering from the removal of calcium deposits in five spots of the lower spine, which caused his absence from Alice's mini-reunion. . . . Also from Pat,

a Christmas letter from Herb Borden telling of Tony Dauphine ('35 but well known to many '36ers) taking up the French horn after losing his left arm in an accident. "Tony was an excellent trombone player in college." I am forwarding the letter to Jim O'Neil, a buddy dating back to Shattuck Academy in Minnesota. . . . And a note from Reid Ewing, '35, who in 1939 was white-watering with Shorty Hubbard. Shorty's canoe overturned and his body was not found for three weeks. He was our freshman and varsity lightweight coxswain.

From Jane and Wiley Post: "We both had hospital confinements in 1992—Jane for removal of a shoulder bone spur and Wiley for recurrence of respiratory problem. But with good recoveries we have resumed normal activities. For the first time in 20 years the triplets were home for their birthday—the 43rd. The candles set off a smoke alarm." . . . Henry Lippitt has served with distinction and honor as Class Agent from time immemorial, originally with Elliott Robinson as co-agent, and alone since Elliott's death in 1985. Now Henry would like to have a back-up. The job now takes little time or effort, and can be very satisfying. Will someone please step forward?

The October nor'easter in the Northeast did tremendous damage over an area where many classmates were at risk. If you suffered, or know another who did, please drop us a note.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

37

Ralph Webster has been busy taking care of his wife, Bunny, who is ill with a respiratory disorder. And Bunny writes that Ralph is doing an excellent job. . . . **Joe Heal** writes that he enjoyed seeing classmates at our 55th Reunion and looks forward to the 60th. His wife, Marion, is in a nursing home but is able to come home afternoons. At present, he is involved with his condo neighbors "battling a three-person board of directors and hoping to replace them at the coming annual meeting."

Martha and Joe Smedile are in their twelfth year in Florida. They were lucky as far as Hurricane Andrew was concerned, with only minor damage to their home. They spent two nights in a hotel during the storm. Martha is doing well after her 1991 stroke and has resumed reading and doing needlepoint. . . . Elvie and Norm Birch are still enjoying their retirement lifestyle in Lakeland, Fla. After the reunion they attended a "Finnfest" in Duluth, Minn., for five days of lectures, displays, tours, and entertainment. Norm was part of the program, giving a talk to about 200 people on his uncle, who sang and played violin and banjo in a three-member band during the early 1930s.

Heard from Ed Hobson, who keeps busy with his large family and their many varied activities. . . . **Bob Harris** retired from Arkwright Insurance Co. as VP-planning in December 1978. He made a delightful trip in September 1991 to Minneapolis for a gala weekend to celebrate the golden wedding anniversary of Patty and Bill Burnet. Bill is handicapped as the result of polio in the early 1950s, but Bob is glad to report that otherwise he is the same likable fellow we knew as an undergraduate. Jane and Bob remain in Wayland, a suburb west of Boston, where they have lived for the past 17 years. Their daugh-

ter and Jane's two sons moved into the house across the street a year after they moved there and, as Bob says, "It is a great arrangement."

Chester Kyih-z Nie and his wife, Virginia, live in Shanghai. He retired in 1972 as senior engineer for the East China Power Bureau. Since 1986 he has been a council member of the Soong Ching Ling Foundation of Shanghai. Chester and Virginia made a six-week "silent" trip to the U.S. in the fall of 1991 to surprise and celebrate his brother James's 75th birthday in Beloit, Wisc. They also visited their daughter Eileen, who works for Oscar Mayer in Madison, Wisc.

Gilbert Mott retired in 1982 as VP of Olin Corp. He is president of the Council of Churches of Greater Bridgeport, Conn. and VP of the Greater Bridgeport Symphony. Gil is also trustee of the Bridgeport Engineering Institute and consultant for the National Executive Service Corps. He and wife Rosemary have three children and four grandchildren. He keeps busy with tennis and golf, along with trips to Australia, New Zealand, Alaska, and Ireland as well as the Danube River Cruise. . . . **Art Zimmerman** sees **Ed Hobson** often and **Joe Keithley** occasionally. He writes, "My latest pleasure—I played singles tennis on my 77th birthday on December 31." (Hope the rest of our class is in such good shape.)

Just received a very late notice that **Chester H. Brown, Jr.**, passed away September 22, 1989. . . . And further sad news that **Charles A. Blessing** died December 17, 1992. He had been a professor of architecture at the University of Detroit and served as director of city planning in Detroit from 1953 to 1977. Charles was noted for his thousands of sketches of ancient and modern cities. He is survived by his wife, Elizabeth, sons Bayard and Curtis, two grandchildren, and a sister.—**Robert H. Thorson**, secretary, 66 Swan Rd., Winchester, MA 01890; **Leonard Seder**, assistant secretary, 1010 Waltham St., 342 B, Lexington, MA 02173

38 55th Reunion

These notes should reach you before the start of the 55th Reunion activities. We have planned a Martha's Vineyard Reunion Trip followed by Technology Day events on campus. So if you have been out of touch, quickly sign up!

Dave Acker informs us that after 28 years in Bedford, Mass., he will be joining forces with a lovely lady named Helen to establish a new home in Sandwich. Congratulations and great happiness for you both as you settle in an area of so many '38ers.

On the sad side we have received word of the passing of **Dave Beaman** late August. Unfortunately, we have no other information. However as most know from *Technique* and reunion books, Dave received SB and SM degrees in mechanical engineering. Following graduation, he worked for Simplex Wire and Cable Co. in equipment engineering for three years until he transferred to Duke University to work on war research. After the War he worked for Daystrom Electric Co., mostly on R&D for the Navy. After 19 years with Daystrom he joined IBM in Poughkeepsie. There he was active with various civic activities and boards and kept up his interest in the U.S. Power Squadron, educating about safe boating practice.

Leonard F. Dowding died January 5, 1992. According to our 50th Class Reunion Book, following SB and SM degrees in chemical engi-

neering he joined Texaco in their refinery operations. He later was affiliated with Jefferson Chemical until his retirement in 1977. *Technique* lists many activities with the American Chemical Society, American Institute of Chemical Engineers, musical clubs, etc.

We would appreciate any first hand information classmates can provide about Dave and Leonard.

Thanks to L.G. Peterson, '36, of Schenectady. We can supplement the April write-up on our late classmate, **Wilbur Rice**. Although his grandfather was one of the first presidents of GE, Wilbur began his career with Pratt and Whitney Aircraft, shortly thereafter joining American Locomotive Co. in the manufacturing of locomotives and combat tanks. He joined the service in 1942, attaining the rank of major in the Air Force before returning to the company in 1946. He subsequently was elected VP of Nathan Manufacturing Co. in N.Y. City. Later he became VP and director of Warren Wire Co. in Pownal, Vt., as well as its affiliate, Cook Manufacturing Co. of Patterson, N.J. In 1963 he was appointed president of Flomatic Corp. in North Hoosick, N.Y., retiring as owner of the company in 1976. At some time he was a member of over two dozen local and national organizations (often board member or president).

James P. Pollock died last October in Hendersonville, N.C. Originally a pre-med major at Dartmouth College, he transferred to MIT after he discovered geology. He graduated from the Institute after two years and earned an SM two years later—both degrees in geology. He was an economic geologist and explored for lead, copper, nickel, and uranium and developed mines in Michigan, Peru, Mexico, and the Philippines as well as Arizona, Canada, Liberia, Saudi Arabia, and Taiwan. He belonged to many professional organizations including fellow of the Society of Economic Geologists and Legion of Honor member of the Society of Mining, Metallurgy, and Exploration. Jim was fond of MIT and supported it loyally through the years even when his son, Jim, went to "that other school in Cambridge."—**Don Severance**, secretary, 39 Hampshire Rd., Wellesley, MA 02181; **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

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Please send news for this column to: **Hal Seykota**, secretary, 2853 Claremont Dr., Tacoma, WA 98407

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The mini-reunion took place as planned on January 4-7, 1993. A letter from class president **Norman Klivans** described the events. "After almost two years of anticipation, planning, work, and a little sweat, the reunion was a real success and pleasure for all who attended. The weather was fantastic, the group had a great time in Naples, Fla., and there were no major glitches or crises. Some critical decisions by the organizing team produced the following results:

1. "There was an excellent local working group, originally Class of 1940 but later expanded to include 1939 and 1941. By broadening the group to three classes, we had more alumni interested and participating. Subsequently, all Florida-based alumni from 1935

to 1945 were invited. 2. Scheduling only three major meals and one boat trip allowed attendees to spend most of their time as they preferred—with friends, in sports activities, shopping, sightseeing, or just doing nothing. 3. Having Paul and Priscilla Gray as our guests on Wednesday night was a happy and fortunate event. 4. Early registration, spurred by a cash drawing, provided an early indication of attendance and interest. 5. Meals were informal buffet-style, prepaid, with a cash bar. The variety of food and casualness appealed to most. Menus were selected to avoid high-priced or specialty items.

"While the general character of the Naples Beach Hotel was judged to be old Florida genteel with a few shabby edges, it was fitting and fairly priced. We had unusually good support during the months prior to and during the reunion from Chris Foglia. She is extremely pleasant to work with, competent, helpful, and knowledgeable—all in all, a credit to the professional Alumni/ae Association staff.

"The multitude of financial transactions has been aptly handled by class treasurer **Dick Babish**. There are still a few adjustments outstanding, but we expect to break even. The \$20 registration fee covered the significant mailing costs, miscellaneous items, overs and unders, and a thank-you party for the local organizing group.

"There were many more late cancellations than expected due to surgery, illness, accidents, and even one death on Christmas Day. Where appropriate, deposits were refunded. About 15 people scratched in the last three weeks.

"Although Chris Foglia brought in VCRs, films, and slides from Tech, there was no need for them since the weather was superb and we had no 'rain date.' However, we did offer to show the films and slides but the turnout was poor. There was no professional photographer or bus transportation involved, both considered unnecessary.

"All files, notes, and records will be kept for about a year in case of questions or problems. If anybody wants information about the reunion, please contact me. Thanks again to all you lovely people who helped make this reunion a great success. We will see many of you again in June 1995."

From Richland, Wash., **Raymond Keyes** writes, "After my unsuccessful rotator cuff surgery two years ago, I anticipated gravitating to a wheelchair. I recovered enough to forget that. I just cannot raise my right arm forward and up very far, or get myself up readily when I fall. But taking my own sweet time when walking, I have rarely fallen down. When I do, I just look around for an able-bodied person(s) for a lift. I find them willing to help. Actually I can get myself up, but it is a struggle. I swim for body exercise and write my memoirs on my PC to exercise my brain."

The column in February's *Technology Review* piqued the curiosity of **Ted Kingsbury**. He called to ask me if I would identify the various award recipients. They are as follows: Bronze Beaver Award to **Thomas Creamer**, **Samuel Goldblith**, **Russell Haden, Jr.**, **Norman Klivans**, and **Alfred Wu**. Lodbell Distinguished Service Award to **Bruce Duffett** and **Tyler Marcy**. Morgan Distinguished Service Award to **Michael Biancardi**, **Walter Helmreich**, and **Marshall McCuen**. Corporate Leadership Award to **Dr. Louis Berger** and **Andrew Kay**. Kane Award to **Dr. Jerry McAfee**. Educational Council Members **Michael Biancardi**, **Roy Brown**, **Walter Helmreich**, **Marshall McCuen**, and **Robert Nedell**.

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The other evening I had a telephone call from Leo Pach, who had recently moved from the San Diego area to Santa Barbara, Calif. He advised that it would make life a lot simpler if retirees did not move. It is a tremendous job, especially if you are one of those people who never throw out anything! He is interested in corresponding with other mechanical engineers who are interested in strengths of materials problems. You can write to him at 285 B Chateau Elise Way, Santa Barbara, CA 93109. Leo also thought that it might be fun if, at the next reunion, people who lived in the dormitories be assigned to the same room they had as seniors. During the conversation, Leo asked to be remembered to **Edgar Bernard**. I called Ed to pass on the greetings. Ed is still regaining his strength after his surgery of last year. He does get out several times every week and is gradually resuming some of his volunteer and organizational activities.

Your telephone calls as well as your letters, are what provide the material for this column. Keep them coming.—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

41

Ivor Collins, our distinguished class treasurer, who has outlasted all class officers, encloses a summary of the class finances for the year and writes, "This year we made the transition to our 'final resting place.'" On March 30, we moved to Carol Woods, and things are working out to our complete satisfaction. We have all the privacy and independence we want, combined with plenty of services and protection. We're on a spacious campus, with lots of trees and greenery and good places to walk. We're part of a community of lively and interesting oldsters with no end of things to enjoy.

"We occupy half of a single-story duplex, with two bedrooms, two baths, living room with dining ell, den, eat-in kitchen, and screened back porch...Guests are always welcome in the central dining room and in our guest room." Their new address: 237 Carol Woods, 750 Weaver Dairy Rd., Chapel Hill, NC 27514, (919) 933-0035.

Ivor also enclosed a note from **Bob (Wallace) Blake**, summarizing his post-election trip to South America. "Last year it was the Norwegian fjords; this year...I decided on the Chilean fjords and the Straits of Magellan, a route traveled by my great-grandfather in 1881 and my father in 1939.

"Had a wonderful time. Three days each in Santiago, Buenos Aires, and Rio, a day at Iguazu Falls, and 15 days at sea on the *Royal Viking Sun* from Valparaiso to Buenos Aires via the inside Passage, Cape Horn, and the Falkland Islands. Good weather all the way, an elegant ship, and delightful traveling companions, including three other MIT alums from the classes of '35, '44, and '47. Passed through Miami going and coming. It seemed very strange to see no sign of either Pan Am or Eastern in this city they once dominated. Very sad for those of us who spent so much of our lives making Pan Am's blue ball known all over the world." Space limitations prevent including Bob's single spaced, six-page, typewritten, trip-diary. Buttonhole him for further interesting details.

Reid Weedon sends a clip from the January 27 issue of *Tech Talk*. It seems that after Hurricane Gloria, Professor Emeritus **Stan Backer** had noted differences in damages to boats in

Marion Harbor with no obvious differences in their moorings. A fellow Marion boater, Norman Doeling, assistant director of the MIT Sea Grant Program, was also looking for answers and enlisted help from Stan who has expertise in ropes and materials. The Sea Grant Program has found that almost no data exists on the forces on moorings caused by various sea conditions and has set up to do some measurements next spring. Boaters may want to contact Stan for any preliminary results before next hurricane season.

Ed Marden and **Sepp Dietzgen** both send a copy of **Irv Stein's** obituary, clipped from the *Boston Globe*. Irv died of cancer at his home in Arlington on January 21, 1992. He was 73. At Tech he participated in *The Tech*, Dramashop, and basketball. After graduation (mathematics), he served in the U.S. Navy as a Lt. (j.g.) and chief radar officer, aboard the aircraft carrier *Hancock* in the Pacific campaign.

After the war Herb worked for W. R. Grace & Co., U.S. Rubber Co., and Polaroid Corp. His 25th Reunion biography reports leaving Polaroid and starting Cambridge Institute for Management Education, Inc., in 1965. The new firm included some professors from Harvard Business School and sought to improve managerial effectiveness in industry by bringing business courses to executives of the Fortune 500 companies.

Herb also served as VP of marketing at the Union National Bank of Lowell and as a member of the marketing department of New England Development and Management Co. of Newton, a developer of shopping malls. After consulting with the Cambridge firm of Abt Associates, developing models for controlling health care costs, he retired in 1990. He was active in the municipal affairs of Arlington, serving on the finance committee and the redevelopment board.

The class expresses its sympathy to his family: three daughters, two sons, a brother, two sisters, and six grandchildren.

President **Sepp Dietzgen** sends a preliminary warning of a mini-reunion dinner at the Faculty Club, MIT Sloan Building, at 6:00 p.m. on June 3, 1993. This is the evening before the 1993 MIT Technology Day. If you did not receive a separate instructions from Sepp or the Alumni/ae Association, sign up through the MIT Alumni/ae Association.—**Charles H. King, Jr.**, secretary, 7509 Sebago Rd., Bethesda, MD 20817, (301) 229-4459

42

On behalf of the Class, sincere appreciation to **Lee Martin** and to his wife **Geraldine**, for their \$3 million gift to the Institute. This significant part of our record-breaking 50th Reunion contribution is designated to support environmental education at MIT.

Classmates, with Jean and me, at the Class of 1940 "Survivors Reunion" included: **Jerry and Lee Martin**, **Flora and Maury Taylor**, **Jean and Bill Johnson**, and **Betsy and Dick Hydeman**, '47. The activities run by **Norm Klivans** and his excellent committee were interesting and well arranged.

Jerry Coe sent a full-page article by **Eric Wormser** which appeared in the *Greenwich (Conn.) Times*. It described a high-speed rail system which could run between Washington and Boston in about 5 1/2 hours. . . . From Brookings, Ore., **Herman Lorence** who attended our 50th Reunion in his RV, plans to continue RV-ing, playing bridge, chess, and music, and doing some sailing.

All of you have already seen the very complete obit on Jack Sheetz in the February/March 1993 issue of the *Technology Review*. I can hardly add anything to it but Jack's touch, to say nothing of his hard work, was felt in all of our Class activities. We shall miss him greatly.

Bill Denhard suggests that we have reunions oftener than once every five years, perhaps smaller in scope than the regular reunions. If you're interested in working on a "mini-reunion" get in touch with Bill, Jerry Coe, or with George Schwartz.

Bernie and Zella, also known as the "Traveling Laveres" hosted Lou Stouse in New Jersey and later met him in New Orleans. They noted that our class was represented by Bob Greenes, Harvey Kram, Jim Stern, Jerry Coe, Ed Vetter, Floyd Lyon and wives (as applicable!) at the NYC museum affair for the MIT Campaign for the future.

We have lost two very active classmates: Bill Rote and Ron Shanin. Bill was associated with Foxboro Co., Doelcam Corp., Minneapolis-Honeywell, and Polaroid. He retired as a VP of Polaroid in 1978. Ron was an independent photographer and journalist and he contributed his skills to many of our reunions. Our sincere sympathies to their families.—Ken Rosett, secretary, 281 Martling Ave., Tarrytown, NY 10591

43 50th Reunion

These are the last class notes you will read before the reunion. The volume of news has not been overwhelming, but I acquired two items while pursuing the Holy Grail (making Class Gift calls).

Herb Twaddle, Arlington Hts., Ill., retired from Amoco in May 1991. He stays busy with his own consulting firm, involved with high-tech ventures, patents, and computer programming. . . . John M. Miller, also "retired" in Cypress, Tex., runs a travel agency with one hand and a restaurant with the other. He travels but does not cook. Regrettably, neither Herb nor John plans to attend the reunion.

A note from Charles Chubb (Course VI), Brookville, N.Y., says, "I am a principal in Nova Technologies, Inc., developing an automatic patient transfer system for moving patients between a bed and a wheelchair. We hope this equipment will help many people to be cared for at home, rather than being forced into nursing homes."

A most unusual Christmas card, featuring flowers and butterflies, reported the presence of Robert A. Miller, III, in Mangalore, India. Bob is a member of an international executive service organization, working as a volunteer with Canam Steel, Ltd., a small producer of castings. He has been preparing a quality manual so the company can sell its products in Europe and the United States. He has also helped design a valve foundry and develop an abrasion-resistant alloy for use in ball mills. Bob's normal work week was six days—48 hours—with Sundays off. He used his holidays to visit ancient temples, some nearly 3,000 years old. It was during his stay in Mangalore that the Hindu-Moslem riots occurred in Ayodhya, with 900 deaths. He is at a loss to understand how a seemingly gentle, introspective religion can produce such violence.

The Red Coats are coming! But don't expect to read about the midnight ride to Prout's Neck until September.—Bob Rorschach, secretary, 2544 S. Norfolk, Tulsa, OK 74114

44

We just received a listing of the Class of 1944 Scholarship Fund recipients for 1991–92. They are: Tony J. Bacigalupe, '94, from Pine City, Minn., who is studying electrical engineering and computer science. Sean W. Barrett, '93, is from Kelso, Wash., and his course is mechanical engineering. Jeffrey M. Connors, '92, hails from Fountain, Colo. He received an SB in mechanical engineering in June 1992. Jane M. Hammer, '93, from Cincinnati, Ohio, is pursuing a course in civil engineering. Giang V. Lam, '94, is from Chesapeake, Va., and is in the mechanical engineering course. Winnie Leung, '94, calls San Francisco home. She is also enrolled in mechanical engineering. Michael J. Person, '92, is from Latham, N.Y., and plans to continue his studies in physics as a graduate student. Magdalena A. Petryniak, '94, hails from Ann Arbor, Mich., and is majoring in political science. Loyda Rodriguez, '93, from Brownsville, Tex., is majoring in the writing program. Our last recipient, Hoang H. Tran, '94, from Houston, is studying electrical engineering and computer science. In addition to their classroom work, these 10 scholars also participate in many extracurricular activities. The class can be proud of its role in helping such worthy young people.

Han Tang Liu writes from Hong Kong that he is looking forward to his retirement in 1993. By then he thinks his new factory, South Textiles (Lanka) Ltd. in Colombo, Sri Lanka, will be operative. Han was founder and chair of South Textiles Ltd. since 1948. He thinks his next address will most probably be in Sausalito, Calif. . . . Arthur Zarlengo entered the University of Chicago Law School after a stint in the U.S. Navy following graduation from MIT. He has practiced law in Denver ever since but is now winding down his practice and is looking forward to retirement.

Paul Robinson retired in 1990 from the Navy Computer and Telecommunications Command. He is still flying a Cessna Skyhawk, which he acquired in 1979. His son, Tim, is also an aviator. Paul has taken up scuba diving and has been diving in Florida, the Cayman Islands, and Grand Turk in the British West Indies. He plans to visit Fiji in November 1993.

Edward Klopfer has traded his engineering practice (except for an occasional forensic job) for another lifelong desire. They have a small ranch just north of Santa Fe and are raising and training Andalusian horses. We wish him the best. . . . We have belatedly received word of the passing of Kevin T. Maroney in January 1985. We extend our sympathy to his loved ones.—Co-secretaries: Andrew F. Corry, P.O. Box 310, W. Hyannisport, MA 02672; Louis R. Demarkles, 77 Circuit Ave., Hyannis, MA 02601

45

By the time you receive these notes, many of you—hopefully—will have received an announcement regarding a Navy V-12 Reunion in June 1994.

A 50th Reunion one year late! Believe it or not, the Institute has no record or list of those individuals who served aboard the U.S.S. *Grad House* during its active duty era. Thus, a crew list or roster has been developed by reviewing the *Techniques* for the Classes of 2-44, 10-44, 6-45, and 2-46. An interesting exercise to say

the least—painful and time consuming—but it allowed me to relive a most important era of my life. The proposed reunion will allow a large group to relive this era in the flesh!

Jean and Class President Chris Boland were here last evening as part of their annual February pilgrimage to New Hampshire—and they brought with them our first cross-country snow of the season. Based upon our discussions, we should be able to report by early fall 50th Reunion details such as committee members, probable off-campus location and activities, plus all the other items you need to know about as June 1995 is only two years around the corner.

In mid-January Charlie Patterson wrote a most amusing letter complaining about the misspelling of his name—both first and last—in recent *Reviews*, plus much detail on family activity. One could easily blame improper spelling on the *Review* staff whereas the truth might well be the inability of all typists or steno types to decipher my handwriting. Then again, possibly the Institute's records are confused (see V-12 comments above): i.e., Patterson with a single "t"!

The 1992 Patterson highlight was the June 20, 1992, wedding of son Chip at the top of the Aspen, Colo., mountains with parents, sister Sue, and family in attendance—all out of breath after the gondola ride. February '93 will have been spent in Maui, Hawaii (Charlie's last visit was in 1946, courtesy of the U.S. Navy).

Dr. David Mintzer retired from Northwestern University in August 1991 as emeritus professor of physics and astronomy and of mechanical engineering. He had been VP of research and dean of science; prior positions at Northwestern were associate dean and acting dean of engineering. Back then, David was an assistant professor of physics at Brown University and associate professor of physics and director of the Laboratory of Marine Physics at Yale.

Another retired professor, Emmett E. Day of Seattle, is still active in boating, skiing, and traveling. "Cruised the Virgin Islands, western Caribbean, and Canadian San Juans. Two grandchildren out of college and acting in movies and theater. This past summer 50 sailors from New Zealand cruised with the Seattle Yacht Club. Visited England, Scotland, and Ireland with our daughter, who was teaching architecture at Liverpool University."

Curt Beck of Pampa, Tex., continues a busy schedule with deep involvement in the United Way, Rotary Club, Outdoor Art Foundation, Community Concert Association, Senior Citizens' Center, and the local council of the Girl Scouts. In late January Art Hall called from Buxton, Maine, to indicate he was prepared to provide seed money toward a 50th Reunion yearbook. Art, a Cabot Carlson retiree who spent most of his career overseas, divides his time between Buxton and Orange Park, Fla., with considerable time sailing in the Caribbean.

Max Ruehmund had kidney failure last May and is now on dialysis four times a day at home. He advises that he is on two transplant lists, but it could be two years before he receives one. Quality of life is poor. Drop Max a line at 89 Wimbledon Dr., Dover, DE 19901-9442. . . . Edna and JJ Strnad followed the crowd to Spain in 1992—a Christmas-card picture standing in front of the Rock of Gibraltar. . . . For Louise and Tom McNamara, they had a travelless year: only two trips—one to Nassau plus another to New Orleans. Louise continues as an adjunct professor at Massasoit, planning to retire this year.

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Carol and Nick Mumford constantly jump around the country visiting several children and 24 grandchildren. While at home, Nick continues his part-time efforts at the Episcopal Diocesan Center in Detroit. . . . Anne and Bob Maglathlen continue to divide their time between Norwell, Mass., and Wareham, Mass., with intermediate trips to Florida, Anne's ancestral home in Prince Edward Island, etc. Anne's hip replacement has been a great success; she will not, however, be competing in the year's Boston Marathon. . . . I particularly enjoy hearing from both Mary Trageser and Mary Hoagland. Boy, but have they been active! . . . And I should not forget Norma Hetrick.

Ellen and Jim Brayton had a great trip to Switzerland and France last fall; more than likely, they are skiing in Switzerland as I write these notes. Jim mentioned in his Christmas note a sail to York Harbor, Maine, but he quickly added that it was not a sail as such—only power! . . . Pete Hickey, who we see regularly, still hangs out in Topsfield, Mass. . . . After rereading George Bickford's note, one must conclude that George and Barbara's family is no different from the rest of us—the kids are more successful than the parents. I hope they will be able to care for us in our dotage!

Jimmie and Tom Stephenson divide their year between Naples, Fla., and Maryville, Tenn., TI's old hometown. Tom listed three big accomplishments in '92—three weeks in Hawaii with son and grandson, a new 32-foot stink pot, plus his best golf handicap ever (no numbers provided). . . . Katy and Jack Freiberger have advised that they avoided deadly illness, jail, divorce, and IRS audits in 1992. . . . Jerry Patterson plans to retire in 1993 and we hope to be able to visit with Jerry and Libby on the Cape this summer. . . . Vince Butler of San Francisco advised that he will attend a V-12 Reunion, but only if we all agree to give him the proper attention a retired Captain USNR deserves. See ya!—Clinton H. Springer, secretary, P.O. Box 288, New Castle, NH 03854

46

I was about to tell of the Class of '46 Scholarship Fund for youngsters that we've been supporting for several years when I opened a letter from our president, Glen Dorflinger. He wrote: "First, the very sad note of the death of roommate Raymond D. 'Bagger' Brown on December 29, 1992. The memorial service was held in Scarsdale, N.Y., on January 2, 1993. Classmates I saw there were Joel Feldstein, Bill Jackson, Bob Spoerl, Jim Craig, Ken Davis, Jack Littlefield, and Ted Henning. . . . Ray had a couple of bouts with cancer. This time it spread to the lymph system, and he went downhill very quickly. . . . Bill Jackson, as Ray's best friend for 60 years, spoke of their experiences and of Ray's dedication to his family (wife Betty, four girls, and one boy)." Yes, to many of us in the V12 as well as others, this was painful news.

On a happier note, Glen tells of our 40th Anniversary Class Gift that is helping the Scholarship Fund. The notice from the MIT Student Financial Aid Office included a letter from a remarkable student, Raj Prabhakar, to Glen, which is condensed as follows: "Raj, a junior from Baltimore, transferred to MIT from the University of Michigan in September 1991. It did not take him long to become an active participant in many MIT clubs and soci-

eties. He has worked in the Cryogenic Lab, designing automated control systems. Raj spends many weekends as an active member of the Debate Society (secretary) and, time allowing, he takes part in the Habitat for Humanity and the Solar Car Club." He would like to thank all of the Class of 1946.

Others mentioned in last year's letter are: Susanne Choe, who is still in pursuit of her goal to become a physician graduating this year, volunteering in inner-city schools, counseling in a "Korean Culture Group" for adopted children, and playing piano several hours a week. Christopher Wren, still a computer science major, works at the MIT Media Lab in the advanced human interface group, plays a lot of athletics as well as the Spanish guitar, and designs kites. Paul Mangione is another senior computer science major, an active Boy Scout-master, is active in the Undergraduate Association, and a member of the Judicial Board. Paul did a surveyed history of hacking at MIT by compiling messages hackers leave behind in MIT's steam tunnel!

Three other new students are in our role. Marty Motto from Loral, N.Y., is a senior computer science major who teaches MIT computer classes doing research projects that involve working with space-shuttle astronauts in the MAN-VEHICLE Lab. She also plays hockey, skis, and sails. Eric Abernathy is a junior from Baltimore majoring in aero-astro, president of his frat, and into most sports. He has worked in the Plasma Fusion Center doing engineering and machine work since June 1991. Kerry James is a sophomore from Glassboro, N.J., and was a member of the Freshman Council and the Gospel Choir. When she's not playing soccer, hockey, or volleyball, she has conducted telecommuting surveys at the Center of Transportation Studies.

One item slipped here from *Tech Review* came from Ed Richardson, one of my old V12/XVI classmates who lives in Winchester, Mass. He sent the sad note that his wife, Madelyn, had passed away last August after a six-year illness with cancer. Still, he intends to keep working for H.P. Hood Inc. in Wilmington, Mass., "for the foreseeable future." Good luck, Eddie.

On the brighter side, Bob Nelson sent prodigious Christmas readings of last year's comings and goings from his home in Lompoc, Calif. To begin with, he spent two weeks in February in England with old friends, and bus-toured to Prague, Budapest, Vienna, and Salzburg in March with former church friends. The next jump was to Calgary, Alberta, in June with wife Marianne as delegates to the General Assembly of the UUA, then on through the Canadian Rockies to Seattle to take a passenger ship up the Inside Passage to Alaska from Juneau to Fairbanks, Denali Park, and Anchorage, and finally back to Seattle and on home. There they quick-tripped up to Mount Whitney in the Sierras and Yosemite with Marianne's sister in September—and so on. When not too busy, Bob as his church treasurer figured out how to put the financial records on the computer with Quicken 4.0. How 'bout that, gang!—Jim Ray, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

47

No letters this month, therefore very little news! David Yablong is president of LaSalle St. Building Corp. in Chicago and lives in Wilmette, Ill. He is a past president of the MIT Club of Chicago. His son, Lawrence, is MIT

'78. . . Charles Butler died in July 1992. He was living in the Philippines and is survived by his wife, Carolyn. No more information available.—R.E. "Bob" McBride, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

48 45th Reunion

Our 45th Reunion is just a few weeks away. Hopefully, you have received the mailing with the registration material. If you have any questions, please call the Alumni/ae Association or me at (401) 245-8963.

Our reunion will consist of three days on Nantucket and two days on the MIT Campus. We plan to go to the Nantucket Inn on May 31, June 1, and 2, before coming to Cambridge for Tech Night at the Pops and Technology Day, June 4. Thursday night before Pops we have planned a buffet in a penthouse-level dining room at the Hyatt overlooking the Charles River and Memorial Drive. Friday night after Technology Day, we will have a class meeting to elect officers whose term will include planning and implementing our 50th Reunion in 1998. You can select to attend any or all parts of the activities this year.

After the class meeting we will have dinner at the MIT Faculty Club with light-hearted comments about things that interest Jay Keyser, Associate Provost for Institute Life. Jay was well received at our 40th Reunion, when he showed how there are two references to camels in the slogan "I'd walk a mile for a Camel." Check the pronunciation of—a k a mile—to see what he meant.

Sonny Monosson and his wife, Gloria, have been active in our class's activities for many years. In addition, Sonny was chairman of our 20th and 25th Reunions and president of our class from 1968–1973. Their first grandson, Alex, is the first male family member besides Sonny. Sonny and Gloria have four daughters and their pet dogs have also been females.

Sonny started Berkeley Financial Corp. which financed inventory and accounts receivable for New England companies. When he tried to automate his operations in 1959, he became interested in the computer business. This led to the formation of Boston Financial & Equity Corp., which did accounts receivable financing, and The Boston Computer Group, a consulting firm.

In an interview with Sonny in *Asset Finance & Leasing Digest* he tells how his business works. He was attracted to leasing because it would generate relatively steady income. But he found it to be a risky business. When his third lease was to a company that went into bankruptcy, he had to learn how to liquidate a \$600,000 computer. After that learning curve, Sonny spent most of his time leasing high tech equipment to high risk companies. Initially many leases were for computer equipment, now the equipment ranges from biotech lab equipment to an advanced piece of Italian equipment to cut marble.

Sonny said the interest rate (used in calculating the terms of the lease) is "set by the degree of desperation of the lessee." As the "lessor of last resort," Sonny earns a 16 to 24 percent margin. Sometimes clients come after they have tried every other possible source. Sonny can arrange the lease because his firm is "prepared to liquidate rapidly." Sonny explains, "You not only have to know your equipment and its secondary market, you also have to understand the legal aspects of obtaining the

equipment in bankruptcy court."

One out of six of his lessees goes bankrupt. He said, "If we get the right rate on the lease and can get the equipment out and remarket it quickly, we can make money." In many cases the equipment is remarketed within a week.

His organization spends a great deal of time qualifying their lessees. This research involves front-end costs and Sonny said, "I learned that the only way to make up for this outlay is have a minimum lease size of \$100,000. The critical factor is our cadre of 45 specially trained financial experts, not the supply of money or need for our services." They are busy servicing over 100 clients with an average lease of \$750,000. They are most active on the West Coast, but also serve Minneapolis, Texas and the East Coast.

About once a month Sonny is the featured speaker at a seminar or other educational meeting. He also writes articles for different publications. He still wears a crew cut, a bow tie and suspenders, eats Pepperidge Farm Goldfish, works in his gardens, and now has added activities with his grandson, Alex.

Harry Jones is active in a hiking group for men over 62. He hikes once a week for 7–9 miles on trails (including the Appalachian Trail) in the Harriman/Bear Mountain Park which lead to old iron mines and interesting views. Recently they went up and down trails on the Palisades overlooking the Hudson River. Another trip to Sandy Hook National Seashore showed how tiring it is to walk on sandy terrain.

Harry has been active in the Educational Council for 12 years. He has recruited nine other alumni to assist in interviewing students interested in attending MIT. Harry is vice-chair for the Educational Council in northern New Jersey.

Charles Steffens retired in 1987 after 39 years with Pratt & Whitney. He and his wife, Julianne (Jolly), fly their Cessna 180 float plane. They have made four trips to Alaska. Charles gives flight instruction on float planes and does pro bono photography in support of Jolly's land conservation activities.

John Brady retired in March 1992 after 17 years at Raytheon and 26 years as a civil servant doing antisubmarine warfare R&D for the Navy in Newport, R.I. His wife, Peggy, and he are in good health and still enjoy skiing and sailing. They have a 36-foot sailboat which they cruise and race. Their four daughters and six grandchildren also live in Rhode Island, so they are able to enjoy their family. John feels fortunate that God has granted them good health, good family, and good friends.

Howard Jacobson is actively working at his company which manufactures a variety of hats in Scranton, Pa. His business still takes him to China and he makes stops in California, Honolulu, Osaka, Hong Kong, Nanjing, and Taipei. Enroute, he and his wife vacationed for a few weeks in Maui. They have four grandchildren. About twice a year they visit our classmate, Henry Warner, and his wife, Ina. Howard serves on the board of a hospital, and he asked for Bill Hoseley's address after reading in the class notes that Bill serves on the boards of two hospitals.

John Little received an honorary degree at the 175th anniversary celebration of the University of Liege in Belgium. He was recognized for his work in queuing which led to the well-known "Little's Law," which relates the average number in queue to the average time spent in queue; for pioneering work in traffic signal optimization; and especially for his extensive research in marketing, where he is considered

a founding father of the field now called marketing science.—Marty Billett, secretary, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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William N. Birnbaum writes that he is "presently completing five years of retirement and only lament that I didn't do it sooner. Life is so full I do not know how I had time to go to work. I would appreciate hearing from Jack Baker or Jim Patel." According to the Alumni/ae Register for 1989, Bill was a consultant to the Grumman Corp. in Bethpage, N.Y. . . . Axel Kaufman writes that he "continues to be a principal at Jung/Brannen Associates, Inc., architects and planners, in Boston. Currently, I am Design Team project manager for a new \$165 million federal courthouse on Fan Pier in Boston."

As gimlet-eyed readers of this column will recall, I told you in the last issue that Peggy and Jack Fogarty went back-packing around the Alps last September. Here are comments on the trip taken from their Christmas letter. "We stayed in pensions or one-star hotels, seldom knowing in the morning where we were going to lay our heads that night, and living primarily on bread and cheese that we ate in train compartments, on tops of mountains, or at the base of statues—wherever we happened to be. We loved hearing Mozart's music on his instruments in his house in Salzburg. One thing, however, made us jealous—their safe streets. People are out at night all over the place—eating, walking, shopping, getting on and off all manner of transportation—buses, boats, or trains, alone, or in groups—without being afraid. Wish we could do that here." Speaking of the benefits of their Eurail passes, Jack says: "It is wonderful to be able to get around in countries where they have real trains, real tracks, and real schedules."

A letter dated February 13, 1992, sent to Tom Toohy, our class president, and forwarded to me, has been mislaid for a whole year sandwiched between papers on my work table. To say that I regret this accident is to minimize my feelings. The letter is from John Harbison, noted composer, conductor, and Pulitzer Prize winner who teaches at MIT thanks to his appointment to the Class of 1949 Professorship. Among the subjects he teaches are undergraduate composition, theory, chamber music, Haydn, Mozart, and Beethoven, Schubert to Mahler. He continues: "When I last wrote to you [Tom Toohy] in 1985, I had just returned from Pittsburgh, where I was composer-in-residence with the Pittsburgh Symphony. Soon thereafter, Andre Previn persuaded me to accept a similar position with the Los Angeles Philharmonic. Because of my commitments at MIT, especially in the rotating chairmanship of our music section, I was able to live in Los Angeles only one year of my three-year appointment. Nevertheless, I managed to fulfill most of my duties at both ends, six times conducting Monday-night concerts in L.A. and teaching my MIT classes on Tuesday! While in California I learned that my cantata, *The Flight Into Egypt*, had won the Pulitzer prize."

Professor Harbison was director of the Festival of New Music at Tanglewood. He maintains an active schedule of conducting with the Utah Symphony, the Los Angeles Chamber Orchestra, and the St. Paul Chamber Orchestra. With the latter organization, he holds the

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position of creative chair. His music has been performed at the Aspen Festival, the Santa Fe Festival, American Music Week Berlin, the Saratoga Festival, Ravinia, and the Ojai Festival where he and Peter Maxwell Davies conducted six concerts of their own music plus music by Mozart with the Scottish Chamber Orchestra.

Twelve of Professor Harbison's pieces are available on CDs, including *Concerto for Double Brass Choir and Orchestra* by the Los Angeles Philharmonic under Andre Previn; *Concerto for Viola and Orchestra* by the New Jersey Symphony under Hugh Wolff with Jaime Laredo, viola; *String Quartets 1 and 2* by the Lydian Quartet; and *Music for Eighteen Winds* by the Baylor University Wind Ensemble. The latter piece was commissioned by the MIT Arts Council and subsequently chosen to represent the United States at the International Rostrum of Composers, which resulted in broadcast on over 50 European stations. (Secretary's note: I am sure I speak for the class in saying that we are honored by Professor Harbison's work under our Class of 1949 Professorship.)

In past column I have noted the exploits of Jim Christopher and his sturdy boat, *Caper*, on the briny deep. Now comes the mailman bearing *Caper's* log (all 18 single-spaced pages), which details, by daily entries, the ship's progress from Toledo, Ohio (May 16, 1992), to Kennebunkport, Maine (September 12, 1992). Space forbids the publication of these notes in their entirety, but I offer the following excerpts:

"Saturday, May 16. Launched *Caper* at Toledo Beach Marina next to Perrysburg, Ohio, where my son lives.

"Friday, May 29. Cast off Erie (Ohio) Yacht Club for Port Colborne, Ont., the Lake Erie end of the Welland Canal (by-passes Niagara Falls). Light headwind, so had to motor the 60-plus miles to make it in daylight. Docked at Marina.

"Talk about an unarmed national border. Customs clearance was an 800-number call to answer a few questions and receive a clearance number (KP0016).

"Monday, June 8. First sign that summer westerly winds may be coming at last—a sailor's dream. Fair winds pushing and chasing you as you mostly go wing-on-wing, a steady downstream current that will not turn against you upon a change of tide."

Jim's log is filled with descriptions of spectacular scenery, mountainous seas, frequent trouble with the motor, broken fittings due to storm damage, groundings on uncharted rocks, friendly natives, a kidnapping—but no smog, clogged freeways, or muggings on the subway. As summers go, Jim's was a winner.—Fletcher Eaton, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

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More news from our active classmates. . . . Paul Kruger is now emeritus professor at Stanford University, currently recalled to active duty for continued research. . . . Dr. Robert Snedeker is retired and living close to the MIT campus. This makes it easy for him to enjoy chemical engineering seminars (where he gets to see Charley Levy and George Krusen on a regular basis). He also participates regularly in Alumni Fund Telethons and Technology Day each year. We'd all like to see more of the Class of 1950 at these affairs. . . . Herbert Ridgeway of St. Mary's, Pa., retired in August

1992 after 41 years with his company, Carbon, and its predecessors.

Tom Shepherd, who has been at the Institute for the past 25 years, has retired as associate director of the MIT Physical Plant. Just before his retirement he became the first recipient of the MIT Trustees Award. The award was presented to Tom by President Charles Vest and is given to a member of the MIT community who has demonstrated "uncommon leadership in the fulfillment of MIT's mission in education, research, and public service." Tom was instrumental in the implementation of MIT's energy conservation plan. The programs he spearheaded have saved the school over \$100 million since 1972. Our congratulations to Tom.

Juan Navia, who graduated from the Food Technology Program in 1950, received the University of Alabama at Birmingham President's Medal at graduation ceremonies last June. He enjoys being part of the MIT Educational Council and interviewing some excellent applicants to MIT. . . . Robert Berg, who has worked at Lincoln Laboratory for the past 41 years, has retired. He feels fortunate to have had very interesting work and wonderful colleagues during his career.

James Cass retired after 42 years in the civil engineering field. He had a varied and interesting work history, including the development of port facilities in Haiti, airport planning at several foreign locations, and finally a program management assignment at the Washington, D.C., airports. . . . Mariano (Nano) Romaguera writes that he and his wife, Virginia, celebrated their 40th wedding anniversary last year. The celebration was postponed to the Christmas holidays, when his entire family of four children, seven grandchildren, three daughters-in-law, a son-in-law with mother, and Nano's own mother could all be with them in Puerto Rico. During the anniversary celebration Mass they renewed wedding vows for another 40 years.

Lester Smith, after retiring several years ago from United Technologies (his only post-Tech employment), embarked on a totally different career as the volunteer curator of a small historical museum. He reports that collecting, researching, cataloging, conserving, exhibiting, and interpreting have been very satisfying and every bit as challenging as his work in propeller vibration analysis. . . . The McKennas marked our 40th anniversary this year as guests of our four children and three spouses on a cruise to the Caribbean. The best part was having everyone together for a week. . . . Keep the news coming.—John T. McKenna, secretary, P.O. Box 146, Cummaquid, MA 02637

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In a brief note from Denver, Ed Richards has sold his diesel engine distributorship and has partially retired. He now spends time helping small clients install their personal computers and trains them to use the equipment for their business needs.

The balance of the items this month are sad in that they relate to the passing of a number of our classmates. . . . We received word from Bill Cavanaugh that David Carlton passed away suddenly last November 18. Dave and his wife, Anne, had come to most of our reunions. Dave was doing the work he loved right to the end. Our condolences to Anne. . . . From Key West, Fla., we learned that Dr. John M. Clegg passed away in January 1989.

One of our more distinguished classmates, **John P. Dowds**, passed away December 10, 1992. Born in Montclair, N.J., John graduated MIT with honors and became a staff geologist with Kerr-McGee. In 1957 he began a successful career lasting over 35 years as an independent geological consultant. He did extensive research into the applications of probability and statistical theory to oil and gas exploration, especially through the use of information theory, statistical mechanics, and Bayesian analysis. His long list of professional honors include being a president of the OKC Engineering Club, director of the Central Oklahoma Society of Petroleum Engineers of AIME, a member of the Natural Gas Commission, and a member of the Oklahoma Independent Producers Association. He pioneered in the use of computers in the interpretation and mapping of geological and engineering data and the application of decision theory to oil technology and management. He lectured at numerous universities including MIT, Stanford, Oklahoma University, Oklahoma State University, and the Colorado School of Mines. He published extensively in the most notable publications of the oil and gas industry. In 1964 he prepared a dissertation for the Nobel Prize Committee. He served his alma mater well as president of the MIT Club of Oklahoma and assisted in the promotion and selection of candidates for entrance to MIT.

I remember John as that very warm and fun person at so many of our class reunions. We will miss him. Our sincerest condolences to his two sons and two daughters and their families.

Another classmate, **Haig Takvorian**, passed away November 23, 1992. Haig retired in June, having been a math teacher for 20 years at the Hebron Andover Marlborough Regional High School in Connecticut. Prior to his teaching career, Haig worked for 10 years at the Naval Supersonic Laboratories at MIT, at North American Aviation and Lockheed in California, and as a research scientist at the UTC Research Lab in East Hartford, Conn. Our sympathies to his wife, Jane, and his son and daughter and their families. . . . From Texas we learned that **Richard Warfield** passed away June 22, 1992. Our condolences to his wife.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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Class president **Bob Lurie** sent a copy of the Student Financial Aid Office's annual letter informing us about the current Class of '52 scholar. The 1992-93 recipient is Raul Rodriguez, who should be now finishing his junior year. Raul is from El Paso, Tex., and is studying chemical engineering. Among other activities, he is a member of the Society of Hispanic Professional Engineers and La Union Chicana por Aztlan. He has worked in the Office of Student Employment for three years to help pay for his education. He is reported to spend up to six hours a week playing table tennis. Well, it's better than playing bridge.

Bob says that some of the committee for our last reunion have, out of habit, I suppose, continued to meet, ostensibly to prepare for our 45th Reunion in 1997. He says he will propose inviting Raul to dinner at some convenient time between table tennis matches.

Randy Paulling writes that he retired last year after 38 years as professor of naval architecture at Berkeley. He sailed in the Pacific Cup race from San Francisco to Hawaii for the third time, this last time double handed

with his youngest son, Tom. He says he is looking forward to more sailing and trout fishing in between consulting jobs. . . . **Erwin Schowengerdt** is another man who likes stress for relaxation. He says he climbed Popocatepetl in February last year, and Kilimanjaro last September.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301, e-mail lacey@hpl.hp.com

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40th Reunion

By the time you read this, the reunion will be only a few weeks away. I hope you all have made your plans. I just got a letter from **Joe Mullen** and he is having difficulty scheduling his attendance, but he is persevering. He and Rita will make it even if he has to interrupt his contract with the Hawaiian Electric Co. He has made special arrangements with them so he can attend and maintain his record of attending all reunions. **Fred Brecher** also lays claim to the distinction of having attended them all. How many of the rest of you can match Joe's and Fred's record.

I have in hand 35 responses to the questionnaire about attendance. I'll list below the names of those that have indicated they will or may attend. This may give some of you added incentive to join us. I know some who are going to attend that are not on the list, like me and **Marty Wohl**. I assume that others are coming but did not respond to the questionnaire. There are other mailings coming your way which will give you an opportunity to let us know that you will be joining us. Many of the comments I have received so far emphasize the anticipation of meeting again old friends that we haven't seen in 10, 20, or 40 years. All I can do at this point is get down on bended knee and plead, but that wouldn't be dignified. I'll recommend that you get on the phone and call some of your old classmates and persuade them to join us. From past experiences, I can almost guarantee you will enjoy yourself.

Among those with uncertain plans are **George Peckar** who says, maybe. **John H. Murry** hopes to attend barring a possible conflict with other plans. **Edward Leonard** says maybe both Cambridge and Cape Cod events and **Howard Stern** indicates both but the Cape is questionable.

G. W. Balz, **Sven Treitel**, **Elmer Selby**, **Rocco Mancini**, and **Jack Friedenthal** indicate attending only the Cambridge events. **S.M. Kleinfelter**, **Robert S. Godfrey**, and **Betty Ann Lehman** will join us for the Cape Cod reunion plans.

Those who said they will attend in both places are: **John Rutigliano**, **Ben Coe**, **Dave Berg**, **John Hilton**, **John R. Walsh**, **Jack Shulman**, **Fred Brecher**, **Joseph Cahn**, **Peter Conlin**, **Michael Levy**, **Jim Ricketts**, **Bill Haberman**, **Leonard Ehrman**, **Joe Mullen**, and **Harold Tseklenis**.

By the time you read the next issue, we will have been to the reunion. I hope we will have elected my replacement and you may get a little more literary style in your notes. However, since there is quite a lag between writing and publishing, I will submit at least one more issue for your edification. I'll include some of the notes you all put in the questionnaires that were too voluminous for this issue. Again, I hope to see many of you at the reunion and we can talk over old times and maybe some of the more recent events of interest. So, until then, have fun.—**Gilbert D. Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331

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Bill Eccles sends word that he is "still retired" but is "acting professor" of electrical and computer engineering at Oklahoma State University. . . . **Paul Spreiregen** writes that he has completed 30 years in Washington, D.C., as an architect and planner. His list of projects over the years is certainly impressive. He organized and conducted the national open competition that produced the design for the National Vietnam Veterans Memorial in Washington. He has just completed a master plan for a visitors center at Mount Vernon, Va. And he designed the Maryland Vietnam Veterans Memorial located near Baltimore. All in all, it's quite a record. . . . **Dave Wiesen** keeps busy as a consultant to small businesses, both through his own company and in association with the Rutgers University Small Business Development Center. He is also very active in MIT affairs, including the MIT Enterprise Forum (he is treasurer of the New York Chapter) and the MIT Club of Northern New Jersey (where he is secretary). Dave's son, Sloan, graduated magna cum laude from the University of Pennsylvania and is now on the staff of the "DC Service Corps" in Washington, D.C.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430, FAX: (203) 576-4983

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Jack Parry reports that he retired from federal service last October and has joined PRC-EMI in Aiken, S.C. He is assisting DOE in converting liquid high-level radioactive waste to a vitrified glass. Jack formerly was a senior fellow with the Advisory Committee on Nuclear Waste in Washington, D.C. Jack's five children and three grandchildren are all doing well; a daughter graduated from Tech in Course VIII in 1988. You can reach Jack at 7 Spyglass Dr., Aiken, SC 29803. . . . **Charles Ladd** has been learning something about Washington politics as a result of his appointment to the Geotechnical Board of the National Research Council last year. . . . After 36 years in public education, including the development of four alternative high schools, **Arnold Langberg** has decided to focus on writing, consulting, and working on "Mind-sun-Limited," a new company that he and two friends have created. Their first client is the visionary architect, Paolo Soleri, whom they are helping to display a major retrospective of his life's work. They hope to have the messages of heroes like Soleri stimulate others to find the heroes within themselves.

After leaving The Rouse Co. in 1988, **Jim Eacker** started his own one-man consulting business to provide a broad range of management consulting services, including financial and project management, and in depth project evaluation and economic analysis. In addition, he has been active in community affairs. He is a founder and president of the Howard County Conservancy, a local land trust, and recently was asked to serve as founding president of the Environmental Fund for Maryland, a federation of environmental organizations seeking access to workplace fund-raising campaigns. He served as chairman of the Howard County, Maryland Commission on Adequate Public Facilities, which developed an innovative approach to growth management that could become a model for other jurisdictions.—**Co-secretaries: Roy M. Salzman**, 4715 Franklin St., Bethesda, MD 20814; **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21042

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Dr. Victor J. Bauer has recently retired as president of Hoechst Roussel Pharmaceut Inc. of Somerville, N.J. . . . **Joseph G. Carleton** is located in Palo Alto, Calif., and is in his ninth year investigating accidents (forensic mechanical engineer). Joe is on the boards of the local YMCA, Kiwanis Club, and Neighbors Abroad (Palo Alto's Sister City Group) and presented a paper on bus fires at the Society of Automotive Engineers Truck and Bus Conference in Toledo, Ohio, last November. Joe's son was married in November. He and his wife, Ruth, are planning a three-week trip to Scandinavia this May.

Margolia C. Gilson is busy with her two grandchildren—3-year-old Sarah and Jacob Lloyd born last September—and is employed part time at Geller Microanalytical. She continues to make jewelry and teach adult education programs. Margy is completing a series of courses in direct marketing management at Bentley College. . . . **Dr. Stanley Hart** has received the V.M. Goldschmidt Award, a gold medal, and certificate from the Geochemical Society for major achievements in geochemistry or cosmochemistry (either a single contribution or a series of publications that have had great influence on a field). Stanley is a senior scientist at the Woods Hole Oceanographic Institution, which he joined in 1989. He has served as a professor in the Department of Earth, Atmospheric, and Planetary Sciences at MIT from 1975 to 1989 and has been a visiting professor at MIT since coming to WHOI. His recent research activities have focused on the origin of hot spots and mantle plumes and the dynamics and evolution of the deep earth.

Russell L. Schweickart of Tiburon, Calif., is president of a startup global communications company, Courier Satellite Services, Inc., in partnership with the Russian Industrial Consortium. The company uses modified SS-25 ICBMs to launch small LEO satellites for developing world communications. . . . **Peter Witherell** of Wilmington, Del. retired from E.I. du Pont de Nemours after 32 years. Peter was a manager in the Engineering Development Laboratory, which is involved in the development of new products and manufacturing systems.

Send news to—**Ralph A. Kohl**, co-secretary, 54 Bound Brook Rd., Newton, MA 02161

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Norman Tepley is currently chairman of the Physics Department at Oakland University in Rochester, Mich. He is also director of the Neuromagnetism Laboratory of the Henry Ford Hospital in Detroit. . . . **Bill Walsh** is VP of Mobil Oil Corp. for the Middle East and Marine Transportation. He reports that this is an interesting mix! Having returned from a second and all-too-short tour in London he has finally had to move to the new corporate headquarters in Virginia.—**John T. Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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35th Reunion

Last news before our 35th Reunion! It's never too late to plan to attend, so just do it! For those really last minute decisions, say Friday, June 5, just call directly to the Black Point Inn at (207) 883-4126. The Inn is all spruced up for our reunion and, just like the musical

Carousel, you'll be able to say, "this was a real nice clambake, and we're all mighty glad we came!"

Jim French writes: "I am continuing as a consultant and technical advisor to the Department of Defense, Jet Propulsion Lab, and industry. The book I coauthored with Dr. Michael Griffin, *Space Vehicle Design*, is selling well." . . . **Carl Dimon** checks in with this report: "After MIT, I earned a PhD in chemistry at Northwestern University. Have worked at Mobil Oil Corp. in the Exploration and Production Research Department all these 31 years. Susan and I are living in Lancaster, Tex."

Sheldon Dean enthuses, "It's been a good year! In October, I was named to the position of air products fellow. This is the highest rung on the technical ladder and I'm the first



Sheldon Dean

appointee. Also, the National Association of Corrosion Engineers named me a fellow at their annual meeting in March." . . . **Vic Teplitz** informs us that he has left the U.S. Arms Control and Disarmament Agency, but continues to consult. He has become chair of the Physics Department at SMU and is a senior advisor on

international coordination at the superconducting super collider program.

At Charles River Associates, **Dan Brand** is encouraged by the new administration's emphasis on infrastructure investment. He says, "Doing interesting work in forecasting travel on proposed high speed rail and mag-lev systems, as well as intelligent vehicle highway systems. Both appear to be of interest to the Clinton team for infrastructure modernization and defense industry conversion. We may be on the threshold of modernizing our ground transportation system yet!" . . . Balancing work and family, **Leon Abulafia** reports that "my consulting business is doing well and our daughter is now 3 years old."

That's all for now. Gotta run. Bags to pack, a reunion to go to! Nancy and I are looking forward to seeing you all there.—**Mike Brose**, secretary, 75 Swarthmore St., Hamden, CT 06517

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Activity on the notes front is picking up! . . . **William Straughan** reports that he is teaching at L.A. Tech University, in the Civil Engineering Department (structures). . . . **Paul Todd** recently moved to the University of Colorado as research professor of chemical engineering; his spouse, Judith, is assistant professor of nursing at the same institution.

In the corporate arena, **Neil Bernstein** has retired as president of the Matec Corp. in Hopkinton, Mass., as reported in a December *Wall Street Journal* article. . . . Another article notes that **Calvin A. Campbell** has returned to Goodman Equipment Co. and other ventures in Chicago, after serving as interim president and CEO of Cyprus Minerals Co. during a search for a permanent manager. . . . **Gary Bracken** reports from Tulsa that he has recently begun the task of organizing and managing a new business unit for the Willbros Group, providing engineering and construction ser-

vices for oil and gas pipelines in the former Soviet Union. His initial project is an \$850 million one from the Tengiz field in Kazakhstan, near the Caspian Sea, to the Russian port of Novorossiysk on the Black Sea. He notes: "1993 promises to be an exciting year!"

Another world traveler, **David Reed Mofett** reports success in negotiating the sale of a cellular phone switching system to the Japanese in December 1992, following months of traveling back and forth to Japan from his Hinsdale, Ill., home base. . . . **Charles Rowe** provides an upbeat report on the foundry business, where he has had his own consulting business for the past three years, appropriately called Rowe Consulting Services. He says business is very good with clients all over North America.

A comprehensive note from **Ed Vrablik** is preceded by the admission that this is his very first Notes effort and that he would not attempt to cover the whole 33 years in one "swell foop." He says, "Carol (my Simmons Sweetheart), sons Kevin and Scott, and I moved back to the Boston area in 1983 to an Acton house across the street from the one the boys were born in. I worked in Prime Computer's CAD/CAM business until 1988 when Prime bought the company and decided that my workstation product line would be replaced by Computervision's SUN hardware. After finishing Acton-Boxboro High, Scott graduated from Bentley in 1990 and is now the 'accounting department' at a medical billing service in Andover. Kevin graduated from BU in 1989 and will get an MD from Penn State College of Medicine (Hershey) in May. He plans to specialize in neurosurgery, combining his mother's (Carol is a BS/RN) medical interests with my scientific/engineering pursuits. Carol has been working as a fashion consultant at a local lady's apparel store to help cover some rather hefty educational expenses."

"Since 1990, I've been involved with a small, new consulting organization that a half dozen of us are trying to build. Our premise is that consultants should be able to offer our years of business experience to help other companies build revenues, find partners, and avoid growth pitfalls. The projects have been diverse and a lot of fun! I continue to be an active RC model airplane flyer/fanatic, as those of you who came to Brewster for our 30th Reunion may remember. I'll bring a plane or two to our 35th as well (early June 1994—mark your calendars)."

Finally, Ed notes that he has "joined the board of a small CAD software company in Littleton at the request of **Chuck Staples** and the rest of the board. We plan to mount an effort to grow this company now that its product line has expanded into a complete turnkey software system. Wish us luck and send lots of orders!"

I thank Ed and others for their inputs; hopefully it will encourage other "first timers" to do the same—maybe it is approaching that time of life!

In Cambridge, 35th Reunion planning continues, with specifics to come within the next few months. In the meantime, your friends and classmates welcome your news, views, and reports!—**Dave Packer**, president, 31 The Great Rd., Bedford, MA 01730, (617) 275-4056

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If memory serves me well—and lately I cannot be sure—this is the first column in five years where all the news has come directly from

you, versus my own gleanings and those of the Alumni/ae Association. Thanks to the contributors—let's hear from more of you.

Joe Cantanzaro writes that he is still practicing intellectual property law with Dilworth and Barrese in Uniondale, N.Y., having been a partner there since 1989. Joe says he "enjoys every minute of it," and would like to hear from others in '60.

Two environmental handbooks by **Bob Feinbaum** have recently been published by the California Chamber of Commerce. One, a recycling handbook for business, shows how to conduct waste assessments and prepare source reductions and recycling plans. The other is a recycling organizer for business to record compliance. Bob is president of Feinbaum Associates, and Oakland, Calif., consulting firm for companies seeking to minimize waste generation, conserve energy, and market innovative products.

From Georgia Tech, **Dick Higgins** writes that he continues as director of their microelectronics research center. In November 1992, Dick participated in the semiconductor industry's national semiconductor strategy workshop. Dick is hoping the new administration takes a fresh look at strategic technologies. . . . **Kern Kenyon** writes from Del Mar, Calif., that he believes he has a new short derivation for Kepler's first law. Kern's derivation has been accepted for publication with one condition (Kern did not tell me which one.) . . . **Edward McCartney** writes, "In late 1991 Nancy and I moved from Newton, Iowa, to Cleveland, Tenn., where I am VP of research for Magic Chef Division of the Maytag Corp."

Chris Simonson's note says that he is finally getting a liberal education by listening to books on tape during his 40-mile commute from Los Altos, Calif., to the Lawrence Livermore Lab. (And I thought H11 et al. gave us all we ever needed!) . . . Another Californian, **Richard Thompson**, writes from Mission Viejo that it has been eight years since he started the Fossil Energy Research Corp. He has been busy ever since reducing emissions from coal-fired power plants to meet Clear Air Act regulations.

Please keep the cards and letters coming. It makes my job so much easier and this column more interesting.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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You can get in touch with me at home via internet! I signed up with America On Line (\$8/month) and have an account. The address: andrewb820@aol.com. If that doesn't mean anything to you, write me a letter (on paper, no less) and I'll try to explain.

As a result of this advance, I have my first column item. . . . **Bob Rein** sends e-mail from Oklahoma: "I'm with a research team studying the flow of fracturing fluids and slurries in hydraulic fractures (petroleum engineering procedure) at the University of Oklahoma. If anyone gets lost and wanders through Oklahoma, stop by and say hi." Thanks Bob, that was well worth the \$8!

Some other news arrived by more conventional means. **Irwin Sobel** writes, "We are enjoying life in Pisa, Italy, where I am a visiting researcher in radiology at the University. Normally I'm with Hewlett-Packard in Palo Alto." . . . **Ray Johnson** is lieutenant governor! Lieutenant governor of Toastmasters International, District 53, that is. That district has

1,900 members in Connecticut, Massachusetts, and New York. In his spare time he puts in a few hours at CIGNA, where he is in information resource management. . . . **Bob Pease** writes that he is alive. . . . **Walter Krolkowski** says he has been employed at Motorola, in Phoenix, Ariz., for the past 19 years. "I've held the title of VP of the technical staff for the past 13 years. My job activities have concentrated on the research, development, and manufacture of silicon semiconductor integrated circuits."

Dick Williams, who lives in Sudbury, Mass., is also a long term. He has spent the last 22 years in the solid state division of MIT's Lincoln Labs. For the last 12 years, he has been leader of the Electrooptical Devices Group. They develop diode lasers, integrated optics, detectors, and optical signal processing devices. He says, "My wife, Christi, and I have raised four children here in Sudbury. One is through Wellesley, one is at Smith, and one will enter Mt. Holyoke in September. The fourth is an 11-year-old boy who will keep his dad young. No early retirement!" . . . **Henry Gabelnick** is still in the contraceptive game. He has been director of CONRAD, an organization funded by USAID through 1997. Sounds nice and stable, Henry. He continues to travel around the world looking for a better contraceptive. Keep writing (or sending bits)—**Andrew Braun**, secretary, 464 Heath Str., Chestnut Hill, MA 02167, e-mail: internet: andrewb820@aol.com.h

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John Rollwagon has been appointed by President Clinton to serve as deputy secretary of commerce. The *New York Times* on February 5, 1993, in a feature article in the Business Day section, indicated that this appointment sets "the tone for a strong relationship between (American) business and the new Democratic Administration." While the appointment was greeted less enthusiastically by the Japanese, executives of American high-tech firms seemed quite pleased with the choice. John is expected to be the "planner and technology visionary" in his new role with the federal government.

John Prussing sent us word via e-mail that he and a colleague have completed a textbook on *Orbital Mechanics*, published by Oxford University Press, 1993. He indicates that no discussion has yet been held concerning the movie rights, but he would like to work with Steven Spielberg if given the opportunity. He is still "professing, playing tennis and the piano, and running." His wife, Laurel, set a new definition for close elections for the Illinois state legislature, by winning a seat by 34 votes out of 40,000 cast in her district. John feels that many of Laurel's supporters now understand why their vote was important. Her background in economics and experience as county auditor may help solve the state's fiscal problems. Both of their older daughters are in graduate school, and their youngest daughter is just starting college. John says that one of his daughters is married to a college professor and this may be an indication of some defective genetic trait.

Dave Vilkomerson writes that he is "happily ensconced with a wife and two daughters in Princeton, N.J., as senior executive officer of EchoCath, Inc.," a company he helped found after years with RCA Labs and Johnson & Johnson. His team of high-tech specialists including Bayard Gardineer, '52, VP of engi-

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Eugene F. Briskman, SM '66

neering, recently received the Matzuk Award from the American Institute of Ultrasound in Medicine for the "Outstanding Technology Contribution of the Year."

Theodore J. Shesskin attended the 30th Reunion in June 1992, and really enjoyed the visit with his old friends, Joe Wyatt, and John Yuan and family. He was impressed by the new dorms and the Stratton student center, and stimulated by the quality of the alumni seminars. His only disappointment was the absence of a response from President Vest to two concerns he expressed regarding undergraduate education.

Richard Hottor writes that he is still at Caltech JPL designing communications systems for planetary spacecraft. He regrets to report that his good friend and classmate, Richard M. Hacker, aero-astro engineering (Course XVI) was killed in a plane crash near Seattle on September 13, 1992. Richard leaves his former wife, Darlene, and their two daughters, Sally and Jennifer.

Join your classmates on MIT1962 computer network: write me for details. As always, even if you don't use high-tech communications, just send a note or card to me via the U.S. Postal Service.—Hank McCarl, secretary, P.O. Box 352, Birmingham, AL 35201-0352

63 30th Reunion

This is one of my last columns (more about that later), and I have a raft of news to report, so here goes. Tony Geisler sends a letter for the first time in years. He and his wife, Dee, recently moved to Diablo, Calif., near San Francisco. He sells raw food to food processors, stuff like tomato paste, lecithin, and oat bran. Dee is an elementary school resource specialist in San Ramon. Rebecca, 21, will graduate in political science this June, and is thinking of law school, while Wendy is a sophomore biology major thinking of med school. Both daughters are at the 'Tute. Tony and Dee are looking forward to our 30th Reunion, and to meeting any classmates who live or wander into the S.F. Bay Area . . . Joel Schindall lives in San Diego with his wife, Alice, and daughters Katie, 10, and Julie, 7. He looks forward to the 30th Reunion, his first! . . . Carl Dover is adjunct professor of physics at Yale and a managing scientist at Brookhaven Lab.

Jim Fidelhotz lives in Puebla (city), Puebla (state), Mexico, where he is a national researcher in linguistics (Spanish, English, Totonaco and Micmac) and professor at Autonomous University of Puebla. . . . From Meg Hickey comes word that she recently exhibited a 100-foot "printout of the logistic equation substituting colors for numbers in the form of two take-offs on Trojan's Column and the Tower of Babel at the Do-while gallery in Boston." Right. Now, Meg, can we get a little more background? . . . Bob Campbell has been elected to the Board of Cigna Corp., and continues as chair, president and CEO of Sun Co. of Philadelphia (which the press release does not describe further).

Bill Vachon lives in Manchester, Mass., where he has a consulting practice in wind energy mechanical issues. From Ron Walter I hear that his daughter, Amy, just started at Penn, while Alison began kindergarten. His wife, Marion, is a professor at Brooklyn Law School, and he is still at Citibank . . . Bob Turtz is a partner in a law firm in Roseland, N.J., while his wife Susan is an administrator at United Jewish Appeal. . . . Ron Rueckwald

has a son (name?) graduating from the 'tute this June. Ron looks forward to the reunion. . . . From Lewisville, Tex., comes a note from Phil Graham, who has managed two of his own companies, but is now with Xerox. . . . Patrick and Elizabeth O'Neil are both class members living in Lexington, Mass., and 'professing' in math/computer science at UMass and consulting in database software.

John Graham remains medical chief at a mental health center in Daly City, Calif., and has a small psychiatry practice. His son Michael is graduating from Brown, and Peter is a high school sophomore. . . . Vic Evins is president of advanced technology at Hoechst Celanese Corp., and lives in Short Hills, N.J. . . . Ruth Nelson lives in Watertown, Mass., has discovered T'ai Chi and Buddhist meditation, and works in computer and network security at GTE. (Isn't it wonderful what a range of vocations and diversion we all pursue?) She has a daughter in grad school in Edinburgh, and a son who is a senior at UMass/Amherst. . . . Paul Richman is chair of Standard Microsystems, a major player in LAN products on Long Island, N.Y. . . . Richard Merrill, Course II, says, "Now I know what it's like to be unemployed!" Folks, can anyone help here?

Sad news from Morrisville, Pa., where William Goldberg died on October 12, 1992. I am sorry I have no more details, and would like to hear from anyone who does so I can pass them on. All our condolences to his family.

This is an early warning: 10 years is long enough for one person to hold any office. At the 30th Reunion I will give up the post of secretary. I hope I have in some small way followed the precedent set by Mike Bertin before me, and invite anyone who is interested to attend the reunion and place his or her hat in the ring (or let me know you are interested). It's a fun job, but high profile. Meanwhile, keep them cards and letters coming.—Phil Marcus, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (410) 750-0184, CompuServe: 72047.333—Internet: 72047.333@compuserve.com

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Just about one year till our 30th Reunion. There is no detailed planning information in hand yet, but I will keep you all posted as it becomes available.

In response to an earlier column item about the activities of James Lerner at the California Air Resources Board, Jeff Michel sent a letter that outlined his environment work in Germany. Jeff's efforts are also focused on the effects of motor-vehicle traffic on air quality. He has been actively campaigning for the coordination of air-quality standards between USA and Europe. Jeff has also been among the alumni who recently founded the MIT Club of Germany. The organization has been registered with the local authorities and held its first official meeting early this year. Jeff has proposed that the club hold some of its events in the eastern part of Germany and perhaps in other countries in eastern Europe. He believes that introducing MIT to high school students there may help to alleviate the effects of decades of isolation and may also encourage admission applications.

Three news items from Washington, D.C., area classmates. The sixth edition of Al Teich's book, *Technology and the Future*, was recently published by St. Martin's Press. . . . Stanley Hallet was named dean of the new School of Architecture and Planning at the

Catholic University of America and was also named a Fellow of the American Institute of Architects. . . . **Roger Lewis** is continuing to wear his three professional hats—practicing architect and planner, professor of architecture at the University of Maryland, and columnist for the *Washington Post* writing about urban design and architecture. His son Kevin is a member of the Class of '96 at MIT and, so far, loves it. He joined the Delta Theta Delta fraternity and is planning to major in physics and economics.

Heartiest congratulations to **Lita Nelsen**, who was promoted from associate director to director of the Institute's Technology Licensing Office. The TLO is the focus of efforts under which MIT moves its technology to society through the marketplace and is probably the most effective of all its counterparts in the academic world.

Best wishes to all for a pleasant summer. Please write.—**Joe Kasper**, secretary, RR 2, Box 4, Norwich, VT 05055

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As a result of talking with **Harry Binswanger** last month, I exchanged e-mail notes with **Dave Trevett**, who also attended high school in Richmond, Va. Dave is currently director of Administrative Information Systems at the University of Chicago, living in Hyde Park. He is still married to Melissa Durvin, also from Richmond, who is head of the university's reference library, and they have a son, Philip, age 13. . . . **Paul Newton** reports that he has been named president and CEO of Boole & Babbage, a software company specializing in mainframe and multi-vendor computer management systems. Paul lives in Danville with his wife of 22 years and two sons, ages 14 and 17. After graduation, Paul went to Dallas for 18 years in the software business and then moved to California six years ago to become president of another software company. . . . **Walter Miller** writes he has been traveling extensively, lecturing in France, Japan, Taiwan and the UK, and consulting for NIH. He continues research at UCSF focusing on genes for enzymes that make steroid hormones, along with a little clinical pediatric endocrinology. Daughter Samantha is now 7 "and has mastered the intricacies of my inside fast ball, which is no longer so fast. Son Nathaniel is 4 and "dedicated to maximizing our household entropy."

From Iowa, **Les Schmerr** called and reported on life on their 40-acre farm with three teenagers (ages 13, 14, 15), complete with goats, chickens, ducks, and geese. When he's not farming or chauffeuring, Les continues his professional work in non-destructive testing, and teaches at Iowa State, where he is associate director of the Center for NDE. Les recently received an achievement award from ASNT for work in "Neural Network Inversion of Uniform-Field Eddy Current Data." Les has been at Iowa since 1969.

Another of the Jay Forrester Undergraduate Systems Program classmates, **Martin Thomas**, called from Boise. Daughter Sally (21) is at the University of Oregon, and son Paul (23) is training to be a brewmaster with a microbrewery in Breckenridge, Colo. Martin recently left Ore-Ida after 13 years and has set up a consulting business focused on his experience at Scott Paper and Ore-Ida in market research and data analysis. Although most of his clients are in consumer products, he reports the issues translate well to all business areas.

On a more somber note, I regret to report the death in April 1992 of **George Steele** of Seattle. George left a widow and infant child. Please write with news or commentary.—**George McKinney**, secretary, 33 Old Orchard Rd., Chestnut Hill, MA, 02167, (617) 890-5771, FAX: (617) 890-3489, e-mail: MCI-mail gwmmii.

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During IAP, a time for MIT students to take something they actually enjoy or that will give them some insight into life after MIT, **Sam Pasternak** gave a series of lectures on opportunities for PhDs outside the laboratory. Sam, who is a partner in Choate, Hall and Stewart, spoke on intellectual property law. . . . The guest commentator for a recent issue of *Design News* was **Craig Fields**, CEO of Microelectronics and Computer Technology Corp. He shared his views on industrial consortia in general and specifically cited many of the ongoing projects and accomplishments at his own MCC. . . . Received a news-filled letter from **Howard and Margaret Shork Chatterton**. Their oldest daughter, Chris, is finishing up a master's degree in Virginia Beach, where she supervises boat-building work for the Navy. Next daughter, Jacquie, graduated from Webb Institute and is now a graduate student at MIT. Youngest, Kathy, is a junior at Virginia Tech majoring in civil engineering. Howard continues his involvement with the volunteer fire company and is now a fire service instructor for the State of Maryland.

Muffet ran in the Marine Corps marathon and qualified for the Boston Marathon again this year.—**Eleanore Klepser**, secretary, 84 Northledge Dr, Snyder, NY 14226-4056, e-mail: vismit66@ubvms.cc.buffalo.edu

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Dave Schramm, who is the Louis Block Professor in the Physical Sciences at the University of Chicago, was recently awarded the 1993 Lilienfeld Prize of the American Physical Society for his work on Nuclear Astrophysics, particularly its cosmological implications. Also, he was recently elected the chairman of the board of trustees of the Aspen Center for Physics. In his spare time Dave continues to climb mountains and fly his plane, a Beech King Air owned under the name Big Bang Aviation, Inc. Dave's son, Cary, who was born at MIT in 1964, is now an art director in Hollywood; he did sets for *Twin Peaks* and now works for CBS. . . . **Rick Dower's** continued enjoyment of teaching physics has resulted in his appointment as Allen Latham Professor of Science at Roxbury Latin School. His inaugural lecture was inspired by his work with the X-ray astronomy group at MIT and was illustrated with slides provided by Professor Hale Bradt.

Roy Gamse is now senior VP of marketing for MCI Consumer Markets, prior to which he was senior VP of customer service. His wife, Joyce, is a substitute teacher at the school of their children, Nicky, 9, and Laura, 8. Joyce is also a docent at the National Gallery of Art. . . . **Akif Azizolu** is the assistant general manager in charge of production and technical affairs at Kordsa a.S., a tire cord fabric manufacturing company in Turkey. The company has been active starting a joint venture in Egypt. . . . **Andy Lemer**, on partial

leave from the National Research Council and his consulting practice with Matrix Group, inc., is spending the year studying urban infrastructure on a Loeb Fellowship at the Harvard Graduate School of Design. . . . **George Nybakken** writes that he has remarried. His wife, Diane, and he built a new house on a lake in Middlebury, Conn. He markets cost polyurethanes. His son works in computer graphics in Harvard Square, and his daughter is a junior at Boston University. As a result, George and Dianne visit Boston quite often.

David McClain proudly announces that June 19, 1993, will be a special day for his family: his son, John, '92, will wed Jennifer Schwartz, '93, on that date. John is in the Course VI-A program and works at Digital in a co-op program. Even though John and Jennifer live only three blocks apart, they met at MIT. . . . **Yupo Chan** has finished the first draft of his book entitled *Facility Location and Land Use*, to be published by McGraw-Hill. . . . **Bill Bloomquist** remarried last Thanksgiving, and he and his wife moved into a big new house that easily holds their combined households. Bill's daughter, Lisa, who recently turned 13, is active in competitive soccer and skiing, and does well in junior high school. . . . **Ralph Sawyer** reports that after 10 years of pondering and puzzlement he has finished writing *The Seven Military Classics of Ancient China*, which is the first overview of the history of Chinese warfare, including tactics, weapons and technology. The book was published in March by Westview, and will be followed by other works on military history and tactics.

Don Davis continues as professor of mathematics at Lehigh University. His book, *The Nature and Power of Mathematics*, which will be published by Princeton University Press this year, developed from a course that he teaches to liberal arts students and deals primarily with non-Euclidean geometry, number theory and cryptography, and fractals. In 1992, Don won an ultramarathon for the third time, a 50-mile race in New York City. His wife, Jean, works as a nurse at a blood center, and his daughter, Joelle, graduated from the University of Rochester and works as a statistician for the Department of Energy in Washington, D.C. . . . **Robert Sitrin** is senior director of biochemical process R&D at Merck Research Labs. He is responsible for process development for all vaccines and biotech products. One third of his staff are MIT graduates.

Bob Trunek is VP of ARCO Products Co., where he is responsible for two refineries, one in Carson, Calif., and the other in Cherry Hill, Wash. He is also in charge of ARCO's new Emission Control reformulated gasoline project and he oversees the technical group at the Technical Center in Anaheim, Calif. This group developed the formula that went into each of the reformulated gasoline products. Bob, his wife, Diane, and their daughter, Patricia, all enjoy roller blading, hang gliding, motorcycles, white water rafting, skiing, camping, and horse shows. Bob is also active as a volunteer in several organizations, including the United Way, the Long Beach Symphony Orchestra, and the American Petroleum Institute. . . . Well, that's the news this month, except for one final personal item. I am now president and CEO of Los Altos Technologies, Inc., an exciting software company that is only two miles from our home in Los Altos. The company's mission is to provide the best security solutions in the open systems, UNIX market. A security product we co-developed with our strategic partner, Woodside Technologies, was recently

chosen Product of the Month by "UNIX World." We have excellent people and are well positioned in a growing market.—**Sharon and Jim Swanson**, co-secretaries, 878 Hoffman Terrace, Los Altos, CA 94024

68 25th Reunion

This is the last column that you will read before the reunion. We thank you for your support over the past 25 years and for your tolerance when we have missed deadlines and made other fumbles. We look forward to seeing you at MIT in June.

One fumble we will admit to is that the following information from **Steve Chamberlain** has been lying around our desk too long. In July 1992, Steve became dean of Syracuse University's College of Engineering where he began as a graduate student. His studies were interrupted by three years Army service during the Vietnam War but clearly were successful. He is the world's leading authority on the anatomy of the horseshoe crab visual system, an important model of basic visual mechanisms. He has also been involved in the regional mineralogy of New York and contributed to the study of biological mineralization in a geological setting. He is scheduled to lead a team to the Mid-Atlantic ridge in June 1993 to study a rare type of deep ocean shrimp and we hope this doesn't conflict with the reunion. He adds, "My life as an academic is greatly enriched by my wife, Dr. Helen Haritou Chamberlain, my students, and my mineral collection."

Having moved from Pittsburgh to Princeton, **Tom Romer** is now on the faculty of Princeton

University with a joint appointment between the Woodrow Wilson School of Public and International Affairs and the Politics Department. . . . **Rick Mazer** has founded The Mazer Group, a management consulting firm, which continues the financial and marketing strategy he did as a partner at Deloitte & Touche. He writes, "Diane, my wife, and Sam, my son, round out my life here in California." . . . Back in the Bay State, **Steve Gamer** is president of Rolling Thunder Enterprises, a software consulting and development firm. . . . Moving a little north to New Hampshire, **Bob MacDonald** is still running a small (10 people) company manufacturing liquid applied industrial membranes. He is VP in charge of "everything no one else wants to do" and chief financial officer. His wife, Leandra, is playing lots of tennis and daughters, Erika (13) and Gayle (11) are showing signs of math wizardry when they are not involved in performing as actresses, singers, dancers, or piano players.

Lolita and Alan Gilkes are extremely proud to announce that their son, Martin, received early admission to MIT for the class of 1997! Alan is a senior member of technical staff at Texas Instruments working in software engineering "because I love it." He visits the "Tute twice a year as TI's representative on MIT's Industrial Advisory Council on Minority Education. . . . Carolyn and **Richard Mushotzky** will probably miss the reunion, but they have a good excuse: they followed our advice and are going to Japan for an extended visit. Richard works for NASA here and will be working with their Japanese counterpart in the Tokyo area. We provided them with background information on living in Japan and our offer still stands for others who are interested. See you soon.—**Gail and Mike Marcus**, secretaries, 8026 Cypress Grove Lane, Cabin John, MD 20818

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An advertisement of sorts, from **Kathryn K. James**: "I taught an original course on operational test and evaluation to over 140 people at the FAA Technical Center. Some of my students were MIT alumni/ae. I then lost 40 pounds on Jenny Craig and weigh less than I did in high school. In case I become unemployed, I can audition for a *Playboy* centerfold." . . . **Dr. Mark A. Rockoff** was recently appointed medical director of the operating rooms at Children's Hospital in Boston. He continues as associate anesthesiologist-in-chief there and associate professor of anesthesia (pediatrics) at Harvard Medical School. Last summer he spent a month working at a children's hospital in Moscow. He recently returned from visiting Russia, Kazakhstan, and Kyrgyzstan to assess the U.S. Humanitarian Assistance Program to the former Soviet Union.

Chris Brooks of Washington Crossing, Pa., reports: "I have joined Recording for the Blind as vice-president of Information Technology, joining the non-profit world after more than 23 years in industry. RFB is a national organization which provides primarily recorded textbooks to people who cannot read standard print. I have been recording computer science texts and doing volunteer work for the past five years, and am excited to be joining the organization on a full-time basis. See box on this page for information on how interested grads can help RFB out."

Michael A. Neschleba's son Patrick "slipped off" to the West Coast to study chemical engineering at Stanford. Michael writes, "Maybe

we can woo him back east for grad school—say, at a solid technological 'Tute in Cambridge. . . . **Sara Clope Long** writes from Cross Plains, Wis., that she received an MD from the Medical College of Pennsylvania in 1990. She is now in residency in psychiatry at the University of Wisconsin Hospital. . . . **Robert H. Dobson** of Atlanta is still a consulting actuary and is back with Millman & Robertson, Inc., after an 11-year absence. He has newly become the president of the Conference of Consulting Actuaries. His wife, Veronica, is two years away from graduating from nursing school. Morbidly, he observes, "It will be helpful when I have my heart attack."

Yours truly participated in an all-day cold-fusion symposium at MIT on January 16 that attracted about 100 participants. MIT Professor **Keith H. Johnson** of the Department of Materials Science and Engineering (look him up in *Fire and Ice*) announced that he and his associates are working toward developing a 100-horse-power, cold-fusion automobile engine. (Sorry, Keith, Toyota will probably beat you.) Keith has also written a thriller-mystery movie script about cold fusion and dark matter. *Breaking Symmetry* will be set at MIT.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Earl Withycombe writes: "I am alive and well, albeit somewhat reticent over the past decade, practicing as an air-quality consultant for Sierra Research in Sacramento. I retired from local politics in the Sierras in 1986 with most of my skin intact, and now volunteer time to the local lung association as a technical gadfly and spokesperson. The line of progeny begun in the spring of 1968 in Cambridge (eventually to number four daughters—Earl's girls) are now either in graduate studies, finishing undergraduate work, or applying for admission to liberal arts programs in the UC system. College bills forced me to close a small private practice in the Sierras in 1988, where my clients were mostly budget-strapped rural county air agencies, and accept a senior position with Sierra Research managing particulate emission studies and permitting services for all manner of large mining and soil disturbance projects. If any Senior House Holmanites or Brookline Street Regulars from the early HoJo era find themselves in this region, give me a call."

Oxford University Press has published **Howie Bluestein's** two-volume textbook *Synoptic-Dynamic Meteorology in Midlatitudes*. . . . **Carl Vankowski** has been promoted from president of Business Imaging at Polaroid Corp. to Group VP for the Asia/Pacific region.

In November 1992, **Joe Kubit** started a new business strategy and investment firm working with small- to medium-sized companies in northern Ohio. . . . **Larry Kelly** says that after nine years of growth and profits, his company, Kelly Computer Systems, has opened offices in Boston and Germany and moved to new headquarters in California. His son, Jamie, 7, is the high scorer on the local soccer team and his daughter, Megan, 10, raises money for the homeless by holding garage sales and selling lemonade.

One of our regular correspondents, **Charles Lieberman** (you may recall his prediction that the economy would begin to grow in the summer of 1992), tells us that last summer he and his family moved to a new house on 1.3 acres set on a serene New Jersey lake. His boys fish in the summer and ice skate in the winter, and

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—Chris Brooks, '69

he and his wife "enjoy the beauty of it all." . . . **David Asbell** and his wife, Michele, also have purchased a house—an old ranch on 2.6 acres, in need of renovation. He is still at Georgia Tech but writes, "I have never seen things so tight there."

That's all for this issue.—**Greg and Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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Leslie Rahl writes: "After 19 years with Citibank, I started my own business in June 1991. Leslie Rahl Associates is a consultancy specializing in swaps, options, and derivative products. Having my own firm has allowed me a more flexible schedule—spend time with my son Kevin (now 2) and my two stepchildren, Kaitlin (12) and Steven (9). . . . **Janet Mertz** was promoted last year to professor of oncology at the University of Wisconsin, Madison. "I have two sons, 3 and 6. The older son is already a math/computer/chess nerd."

. . . **Jonathan Lukoff** writes: "Linda and I are the proud parents of Serah Michelle, born June 5, 1992. Having a child in our lives has brought us unimaginable joy. She has already seen the MIT campus, and I have suggested in my best paternal manner that she be the first girl to go to the moon. Her mother and my mother-in-law were horrified at the thought."

Al Solish writes: "Peg (Margaret Frerking, '72), our three children (Ben, 10, Daniel, 7, and Barbara, 3), and I are still in La Canada near JPL. Pet is a group supervisor at JPL, and I practice ophthalmology with a glaucoma subspecialty. My brother joined me two years ago, and between us we have six offices. We are kept business running between them. I'd enjoy hearing from any of my old friends from the 'Tute or AEP: 1425 Elvago St., La Canada, CA 91011." . . . **Mark Oshin** bought his first house in July 1992 and is a substitute teacher in Portland since moving there two years ago. He is interested in constructing "variety cryptic" crosswords like the ones in *Harper's* or *Atlantic*, but more difficult. He'd enjoy hearing from anyone with an interest in the same: 3837 S.E. Salmon St., Portland, OR 97214-4339.

John Veranth is in Utah working as an engineer writing outdoor books for fun and devoting a lot of time to environmental activism. . . . Please send your notes to: **R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77834-1808

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James Roxlo reports that he is still working at Du Pont and still enjoying it. He completed start-up of a nylon plant in Indonesia last year but is hoping to stay closer to home (Richmond, Va.) in 1993. . . . **Paul Levy** has joined the Conoco Environmental Corp. in Bridgewater, Mass., as CEO. . . . **Rev. Dr. Greg Chisholm**, S.J., is an engineer, a deacon, and a candidate for the priesthood. He has trained at Heythrop College London and the Weston School of Theology in Cambridge. . . . **Bob Reiter** is in Bethesda, Md., and writes, "My family and I are happy and in good health as we celebrate our Lord's birth once again. All three kids are in elementary school (grades 2, 4, and 7) and doing fine. I've been working for 10 years now at IBM Federal Systems on the FAA's Advanced Automation System air traffic control project and haven't gotten bored yet!"

The sight of an eight-oared crew shell gliding across smooth water still quickens my pulse."

Marty Shinko writes that he has chosen to leave his job doing quality assurance at UNISYS for NASA. He is temporarily working at NUS Corp. He is also taking courses at George Washington University in downtown D.C. and recently got a ham license but has not yet set up a station. Daughter Kelly is in the second grade and is "quite the socialite, invited to many birthday parties and sleepovers." Daughter Amy (4) is at preschool two days and runs faster than anyone else there. Marty and wife, Cher, just returned from a tenth anniversary Caribbean cruise.

Finally, you will be interested in knowing that the current Class of '72 scholarship recipient is Michael Kreuze, '93, Course X, who also does UROP, lives in Student House, and plays trumpet and hockey. All those Alumni/ae Fund contributions actually help out real people!—**Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

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20th Reunion

It is surely coincidence, but the 20 percent of our class that went on to medical practice always seems to be heard from with news when the donation drive and solicitation season is upon us. **Joel Franck**, for example, is very busy in his private neurosurgical practice in Maine, pursuing clinical research in computer-assisted brain surgery and innovative spine procedures. His fiancée, Rachel, is his OR nurse and a medical artist. His family now has five horses, and Joel himself has taken up polo fanatically while looking for a neurosurgical partner.

James Conroy's practice is in sports medicine, in the San Jose area. He is married with two small girls and still keeps up with volleyball. . . . Another Californian, transplanted, is **Debra Judelson**, who is still in private practice in internal medicine and cardiology in Beverly Hills. She was recently elected VP of the American Medical Women's Association.

Some non-doctors came through with news as well. **Charles Bryant** was recently promoted to senior planner with the Planning and Building office of the City of Oakland. After 11 years with the city, he is responsible for overseeing the update of the city's General Plan, as well as several neighborhood studies and the 1990 Census. . . . Back East, **John Chandler** has moved out to the country—Harvard, Mass., that is. They have three acres on a hill-top with a terrific view of Mt. Wachusett and the Ft. Devens firing range.

And **Tom Lydon**, who always deserves his own paragraph, has been promoted to department manager of the software development center at Raytheon's Tewksbury facility. There he manages over 100 engineers and all software development facilities for programs such as Patriot, Hawk, and AMRAAM. Kids Mary Elizabeth ('02), Tommy ('03), Eddie ('06), and Maura ('09) and wife, Mary Paula, all doing well. Hello (need it be said?) to **Bill Billing**, **Dennis Intravia**, and **Wes Grandmont** of the dreaded Theta Chi-spawned BLYTRAMONT Institute of Thinkology (BIT for short).

All is quiet at home, where, in the spirit of owner-built houses never being complete, Ruth is at it again redecorating and repapering and refurbishing and is otherwise hip-deep in the stuff she loves. Write!—**Robert M.O. Sutton**, Sr., secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

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Welcome to this edition of *New Baby News!* There are five new Institute recruits available now, beginning with Anna Marie, daughter of myself, **Dave Withee**, and Mary. She was born December 6 and placed in our loving arms 10 days later. We've been waiting four years for a child to adopt and now have arguably the most precious little girl ever to grace the planet. (Yes, you are welcome to argue!) . . . Baby #2 is **Samantha Frances**, born September 7 to **Paul Moroney** and wife, Jean. All four of their children are doing well. Paul is in his fourteenth year with General Instrument, where he is VP for systems engineering. They reside in Olivenhaim, Calif. . . . Baby #3 was **Christmas Eve** to **Carl Howe** and wife, Carolyn, their first. They are counting on their experience with all-nighters at school to get them through the midnight feedings. (It's helping me!) They live in Stow, Mass. . . . Baby #4, **Aaron Ross**, is the third son of **Jamie Silverstein Stolper** and her husband David, '73, and was born last June. Jamie is on hiatus from her job in economic forecasting and consulting. David stays busy in the professional photographic equipment manufacturing business. . . . Our fifth baby in this issue is **Thomas Armstrong**, born January 24, 1992, as the second son to **Jeffrey Ng** and wife, Winnie. Also contributing to a memorable and busy 1992 was the 100th birthday in Hong Kong of his mother, Winnie gaining professional accreditation from the Computer Science Department at Southern Connecticut State, and getting several of his architectural projects under construction. Jeffrey and Winnie live in Fairfield, Conn.

Daniel Reinhardt is an internist and administrator in Uniondale, N.Y. He, his wife, and three children live in East Meadow. . . . **Luca Bencini-Tibo** send word of having survived Hurricane Andrew. It is interesting that that information came in a soaked envelope that landed on my car windshield! . . . **Liz (Bag-nall) Scarito** graduated from University of Maryland Medical School last year and is now "doing" an internal medicine residence at The York Hospital. Her son, Mike, is into computers, country music, gardening and, like his father, Phil, is not too bad a cook. . . . **Charles Bruno** stays busy with his two businesses. Charlie's Mustangs (really his hobby) is a high performance specialty shop and has grown 80 percent over the last two years. He advertises in all the national magazines dealing with the Ford Mustang. (There must be so many!) Bruno Engineering is what probably really pays the bills and is one more excuse for still being single.

Paul Chernick founded a utility consulting firm, Resource Insight, six years ago and now has 15 employees in Boston and Rutland, Vt. They work with anyone—consumer advocates, utilities, environmentalists, large consumers, etc.—throughout the United States and Canada on electric and gas resource planning, including conservation programs. He and wife, Gail, have 4-year-old twins and a teenager and give yet another vote in favor of the joys and exhaustion of parenting. . . . **Drew Jaglom** claims to still be surviving at his own law firm. His forte is general business law with an interesting focus on distribution and marketing of food and wine companies and software firms. His two kids are "terrific." They live in Bronxville, N.Y. . . . **Charles Calhoun** recently toured the wealth of Victorian homes in Saratoga Springs, N.Y. (Charles, and any other architects or builders out there, look me up at the Heatilator booth at future NAHB

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shows!) . . . **Johan Norvik** is one of this issue's travelers. After being in England with the Unisys Europe-Africa division, he's now in Boca Raton with the Latin America and Caribbean group. He'll be responsible for headquarters marketing activities for the government and public sector.

Stanley Young is still in New Jersey and still at Unigene trying to scale up their first biotech product. Wife, Jasmine, is running Vernon (the city) and kids are busy. He's requesting a reunion of Jack Floreyites. . . . **Jack Rich** has worked for 12 years at Kronos, Inc., which went public last June. He's the director of international business development, allowing him to take junkies to places such as Australia. Wife, Alice, and son are doing fine at home in Weston, Mass. . . . Finally, but assuredly not least, **Paul Levy** is staying busy with the environment. In addition to lecturing on environmental policy in the Department of Urban Studies and Planning, he was recently involved in taking over a bankrupt (no where to go but up) environmental engineering firm in Bridgewater. His specialty seems to be looking for wastes on properties prior to transfer.

While that begs for editorial comment, I will refrain and instead thank everyone for writing in and request more of the same for future issues. It's fun reading about all of the rest of you!—**David Withee**, secretary, 1202 Linden Dr., Mt. Pleasant, IA 52641

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Please send news for this column to: **Jennifer Gordon**, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

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Please send news. There is always room for more! . . . From **Michaki Golan**: "Set a personal employment record, reaching five years at Data General in 1992. Working on CAE/CAD tools and libraries and UNIX System Administration. Sailed the Caribbean for a week and sail Narragansett Bay most Tuesday nights and weekends." . . . **John Sass** writes: "Not very exciting stuff, but I'm now a teacher at Northampton High School in a self-contained classroom with kids at risk of dropping out. I don't use any of my MIT education but everyone is impressed that I went there. I'm very happy at school and at home—married with three kids, including a 16-year-old niece." . . . **Neil Kaden** has "started a new assignment at BNR/Northern Telecom as senior manager, PCS Integration and Support. From the ivory tower of strategic planning of Cellular Radio and PCS national standards to the harsh realities of building up a new organization to do systems integration, verification, and deployment of new PCS products, worldwide."

Robert Sand is "one-half of the senior scientist staff at our small business—North Star Research Corp. here in Albuquerque, N.M. This last year has been fun, with catalog sales of semi-custom high-voltage equipment and R&D in compact particle accelerators. My wife, Kath, is working on her doctorate, and the kids, Erica and Matt, are now 13 and 11." . . . **Barry Goldman** writes: "A long time has passed since I last wrote. In fact, since then my second son was born and he will be 2 in February [1993]. His name is Seth. My older son, Jason, will be 5 in February [1993] and is

already into computers. His birthday party will be at a computer store and learning center. Jason has taught me a few things about Windows. On the business side, I have now been with Goldman, Sachs & Co. (no relation) for almost six years, where my primary responsibility is the worldwide coordination of the Financial Operations New Product Committee. In this role, I manage preparations for the introduction and support of new products in the administrative and operations areas.

Kerry Emanuel is the director of the Center for Meteorology and Physical Oceanography at the Tute. . . . We have other news out of the Tute. The Class of 1976 Scholarship was awarded again to Raynard Hinds, '93. Mr. Hinds, from the report your secretary has received, is doing well and has managed an internship at Hewlett-Packard as well as participating in varsity track and field. . . . Word has seeped back to me from the West Coast that **Tom Freeman** and **Mary Ann Mosher** are now married to each other. We have not heard from either of them directly in more than 16 years. There are quite a number of similarly non-communicative classmates. If anyone knows any classmates who have not written, please give them a nudge. Class notes are a pleasant way to keep track of geographically distant friends, but to do so we need news. Please help.

As for your secretary, he continues to trade. We have now witnessed the near collapse of the European Monetary System (EMS), with concomitant big swings in exchange rates; treasury bond prices hitting new highs (and yields, new lows), reaching levels not seen in seven years; stock indices hitting all-time record highs; and precious metals plunging to levels I have not seen since the start of my career trading futures 17 years ago. What times! And the volatility appears to be accelerating as the world appears to lurch from one financial extreme to the next. This is not a trading environment for the weak of heart. Fortunately, my system is inured to this from so many years of coping with both a lot of volatility and a lot of leverage. The computer and telecommunications side of your secretary's business life provide a retreat from the stresses of trading. It makes for an interesting mix; there are no dull moments.

Please write, fax or call. We need your news.—**Arthur J. Carp**, secretary, Quantalytics, Inc., 220 Henley Rd., Woodmere, NY 11598-2523, (516) 295-3632, fax (516) 295-3230

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Alec Berman writes to us for the first time since graduation. Alec graduated from Stanford Law School in 1980 and then joined IBM's legal department. After a number of different assignments, all in New York state, he is now corporate counsel for litigation with responsibility for personnel-related and commercial litigation. In February 1991, he married Kara Donahue, Tufts '85, and in February 1992 they moved into a 120-year-old Italianate Revival house in Riverside, Conn. . . . It's never too late for a classmate to get in touch. If you haven't written in a while (or ever), this is definitely a good time! . . . **Jeffrey Casper** is still working at SRI International in Menlo Park, Calif. He continues to take early-morning engineering and engineering management courses at Santa Clara University. Although they keep him very busy, he plans to take time off to be the best man at Steven

Buchthal's wedding this summer.

We are sorry to learn that Tom Mills has taken disability retirement for health reasons. He notes with irony that his appointment as associate clinical professor in psychiatry had just become official on the day that he submitted his retirement papers. Tom has AIDS; he was planning a hiking trip to Maui and a biking trip in Provence in his attempt to keep as active as possible. . . . Last year Jed Fuhrman was promoted to full professor at USC. His wife, Dorothy Comeau, '79, is an intern in general surgery at L. A. County/USC Medical Center. . . . Daniel Wolk reports that his family practice, his environmental work, and his two children keep him busy at his home outside Philadelphia.

Also in the medical field are Steve Bader and his wife, an anesthesiologist at Brigham and Women's Hospital in Boston. Steve's dental practice in the Boston suburbs has grown to 10 doctors and a staff of 35. His children are now almost 3 and 5 years old, and all are doing well. . . . Stephen Blatt enjoyed the reunion. "Let's have a larger crowd next time," he implores. He and his wife, Faith, are kept busy by Benjamin, 2, and Zachary, 4. Steve is doing systems engineering at Lockheed Sanders. Even though the elections are well behind us, Steve had some stories about the New Hampshire primaries. He reports that he "knelt at Bill Clinton's feet (literally), watched Paul and Nikki Tsongas get mobbed by the media, saw George Bush fail to energize a half-empty school gymnasium, and had brunch with Pat Buchanan (one Sunday after doing the news shows he sat at the next table over from me and my wife)." . . . A joint note from Richard Smiley and Barbara Thornton announces the birth of their first child, Brian Thornton Smiley, on June 24, 1992. Rich continues in the Department of Anesthesiology at Columbia; Barbara continues at Delta Petroleum, trading oil mostly in the Caribbean. They live in White Plains, N.Y.

Paul and I continue to be busy with our three children: Joia is 10, Kellen, 7, and Brielle, 4. Kellen is learning keyboarding at school on a Macintosh. I'm going to let him finish this article. Write soon! Hi, this is Kellen. Daddy and I just finished my new military helicopter, Cobra model. I like all vehicles and all aircraft. Send your news to my mom.—Ninamarie Maragioglio, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153, hertz@xip.nrl.navy.mil

78 15th Reunion

Make your plans now to join friends and classmates at our 15th Reunion, to be held June 3–6 at the Tute. Our class has traditionally busted the attendance projections wide open at past reunions, and by all indications, the same thing will happen at this one. It's great fun! Send in your registration soon!

J. Scott Ferguson sends us a note from Narragansett, R.I.: "My wife, Joyce Miller, and I are both senior scientists at S.A.I.C. in Newport, R.I., specializing in developing and using marine science data acquisition and analysis systems onboard research ships. We each spend a significant amount of time at sea, usually supporting high-resolution seafloor mapping efforts. We can have fun, too!"

Bob Asher writes, "I am excited about moving my patent law practice to the firm of Bromberg & Sunstein in Boston. My wife, Linda, and I celebrated with two weeks in northern France, including Paris, Normandy,

Brittany, and the Loire Valley. Linda also returned to a new position as an attorney with a firm in Worcester." Bob and Linda are living in Needham, Mass.

Tapio Kuusinen also brings us up to date: "I have been at Pacific Northwest Laboratory, a federal government lab working on energy and environmental policy, for nearly three years. I am living with my wife, Eva, and 4-year-old daughter Christina in nearby Kennewick, Wash., in a desert region averaging six inches of precipitation annually. Lots of sunny weather has resulted in only a marginal improvement in my golf game, however."

Celia Berry sent a long note: "I am working as a staff materials engineer at Motorola, Inc., in Schaumburg, Ill. I work on new product development of two-way communications systems. At the same location are Karl Wyatt, '81, and Michelle Harton, '83. Nothing new to report, but I have been in touch with Cordelia Price in Houston, Elaine Harris in Philadelphia, Vincent James in Boston, Lisa Egbunu-Davis, '79, in Indianapolis, Diane (Waters) Hargrove in Grenada, Miss., Mark Smith in Atlanta, Stan Washington, '77, in Chicago, Bill Gilchrist, '77, in Birmingham, and JoAnn Politano in Pittsburgh. It's nice to know that friendships formed at MIT last a long time!"

Ruth Shragowitz is living in the Big Bad Apple: "After graduating from UC/Berkeley and becoming a registered architect in California, I moved to New York City to work in real estate. Most recently, I have been working as director of development at David Frankel Realty, Inc., where I supervise the major construction projects of the firm. I also handle all retail and commercial leasing for the company."

Mike Harlan sends news from Sierra Madre, Calif., "I have recently changed positions, leaving McKinsey & Co. after eight years of management consulting to join Allied Signal Aerospace Co. As director, business development, I'll share responsibility for finding ways to grow despite the contraction of the defense and commercial transport markets. I'm delighted to have this opportunity to join a company that is doing the right things to be a long-term winner!"

Lann Salyard has introduced new technology to Haverford, Pa.: "I'm enjoying my work as a psychiatrist at two community mental health centers. I'm especially excited to be 'the first on my block' to have my patients' prescriptions on a spreadsheet, and then run them off on the printer! (I sign them, of course!) Routine for MIT, but a great leap forward in community mental health!"

Bob Milne sent his Christmas letter from Scotland. Bob's business, Intelligent Applications, specializes in artificial intelligence applications. He says that it is doing well in spite of the recession due to a combination of mature products and funded development projects. A major European R&D project called "TIGER" has resulted in "several climbing (or business) trips to France and Spain." Bob lives with his wife, Val, 8-year-old Alex, and 6-year-old Rosemary. The kids are involved in riding competitions. We continue with an excerpt from their letter: "Because Bob's company received a Queen's Award for Technology, he was invited to a party of all the winners at Buckingham Palace. He got to meet the Queen and tried to explain artificial intelligence to her. We don't think she understood, but did say that the palace computers rarely work. Also at the party he got to meet John Major, the prime minister. Rob reports that he doesn't seem like such a nerd once you get to

know him." This year will be the Milnes' tenth year in Scotland.

Finally, the Reunion Committee has been hard at work producing a fantastic program for our reunion. Registration forms should have been received by now. The class activities are structured to run on a break-even basis. Most importantly, they're structured to be fun, and give a chance for classmates to renew old friendships or make new ones. The Reunion Committee, chaired by Frances Scovil, includes Karyn Altman, John Begg, Cindy (Husmann) Berman, David Browne, Jose Cisneros, Jerry Cole, Paul Lagace, Paul Malchodi, Daniel Palka, Peter Santeusano, and Jon Sieber.

Your class secretary and wife, Diane Curtis, look forward to seeing YOU at the reunion!—Jim Bidigare, secretary, 9095 North Street Rd. NW, Newark, OH 43055-9538, (614) 745-2676

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Heinz Stubblefield writes, "After having traveled over 20,000 miles (Seoul, Beijing, Mexico City, etc.) over the last year in my previous position, I have started working and living in a small town outside of Dusseldorf, Germany, called Hagen. I am the director of finance and MIS at Walterrose, a subsidiary of Raychem Corp. that makes accessory products for the world-wide telecommunications market. I am slated to do a two-year stint here. Over the last four months I have been on the road at least 30 percent of the time, mainly to Brussels and Munich. I hope to get to the Alps this winter for a little skiing. After San Francisco, getting used to any other city is a challenge, but so far so good. In July I went to the North Sea Jazz Festival in Den Haag, Netherlands. In September I went to Amsterdam for some Surinamese culture, and a few weeks ago I saw Al Jarreau and the Dance Theatre of Harlem in Brussels. Europe definitely offers some good breaks from the drudgery of work."

Douglas Morrow has moved from California to Chicago, and has given up manufacturing management for software development and marketing. His second child was expected in early December of last year. (Boy or girl, Douglas?) . . . Thatcher Root has received tenure in the Chemical Engineering Department of the University of Wisconsin, Madison. . . . Henry Mitchel is a programmer/analyst at Datastorm Technologies. He was a "prime mover" in the creation of the recently released product Procomm Plus for Windows. Henry and his wife have three daughters—ages 10, 8, and 7 weeks (at this writing). His comments: "I haven't worked so hard or been so burned out since I graduated from the Tute!" (An inspiring testimonial to fatherhood!) Henry and family live in Columbia, Missouri.

Astrid Howard writes, "Greetings to all MIT Shakespeare Ensemble members. I now live in Belgium and, except for some translation work, I have completely left science for theatre. I work as a director, stage manager, and sometimes in production/administration. For someone whose worst subject in high school was French, I now speak it fairly well and have begun to learn Dutch, the other language in Belgium." . . . Jacky Lee is in his thirteenth year with the Duke Power Co. in Charlotte, N.C. As senior engineer, he is in charge of day-to-day safety analysis support for the company's seven pressurized water reactors. However, he is in the midst of preparing for a career change, and is halfway through the

course work to become a certified financial planner. Jack and veterinarian Clair Leslie have been married since May 1989.

Richard Gray has been in Omaha, Neb., for the last four years "working on the railroad"—for Union Pacific, that is, in capacity planning and construction management. He has two kids, ages 2 and 4, and finds Omaha a great place to raise a family.

I've just done my annual experiment to see how long it takes news to reach me when sent along with contributions to MIT. The result: a note I dated December 9, 1992, came back to me in time for the May/June column. That means there's a five-month lag. However, since I am writing the May/June column in early February, you can cut the lag down to three months by writing to me directly. Hope to hear from you soon.—**Sharon Lowenheim**, secretary, 98-30 67 Avenue, Apt. 6E, Forest Hills, NY 11374

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After graduating from NYU Medical School in 1984, **Cindy Carter** spent four years in psychiatric residency training at New England Medical Center. She completed a National Health Service Corps obligation in 1992 and is currently employed as a staff psychiatrist at the Harry Stack Sullivan Mental Health Clinic in Norwich, N.Y. . . . Meteorologist **James Franklin** conducted a research flight into Hurricane Andrew one day before it struck his home in Miami. He says: "Hurricanes are much more fun to experience in the air than from on the ground, feeling your home shake

and rattle, hearing things break in other rooms. The next time I fly into a hurricane, it will certainly be with a different perspective!" James hopes to have all repairs complete by the time you read this. . . . This year looks promising for **Jeffrey deRoulet**. Two local firms are merging with his company, Architects Northwest, creating a 13-person design house. The company will be taking their stock house plan marketing national. Jeffrey also does pro bono work for Habitat for Humanity.

Three short notes this month. . . . **Chien Huang** is still living on Long Island, and by now he and his wife are no longer a "dince" (double income no children couple). Chien said he was looking forward to parenting. Let us know if you had a boy or a girl! . . . **Susan Wildin** is assistant professor of pediatrics in the Division of Child Development at the University of Texas Medical Branch in Galveston, Tex. . . . About five months ago, **Steven Berez** moved from Pennsylvania back to Boston with his wife, Peggy Lowenstein, and two children, Daniel (2) and Julie (8 months). Steven will be working with Bain and Co.

Please send your news to: **Kim Zaugg**, secretary, 2384 Leslie Cir., Ann Arbor, MI 48105, (313) 665-2365, vayda@erim.org

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We have lots of news this month.

New positions: **Richard Heller** has returned to the Boston area and taken an administrative position at Brandeis University. . . . We learn that **Rebecca Henderson** of the Sloan School has been selected as one of the first holders of

the Robert N. Noyce Career Development Professorship. Rebecca joined Sloan in 1988 as an assistant professor of strategic management, after receiving a PhD that year from Harvard. Her research is in the economics of technological change, technology strategy, manufacturing strategy, and the management of new product development. . . . **Dean Daniels** informs us that he is now working at Oracle Corp. in northern California, in the RDBMS Kernal Group.

New titles: Bain & Company, the international management consulting firm, has named **Robert Bechek** a VP and partner of the firm. Robert joined Bain in 1987 after graduating from Harvard B-School, and has worked at Bain in helping technology-based and industrial clients with a variety of strategic and operational management challenges. Prior to joining Bain, Robert's positions included VP and general manager of AKR Robotics. He and his wife, Jacqueline, now live with their three children in Needham, Mass. . . . **Jeffrey Anderson** has been named senior VP for European sales and marketing at R.R. Donnelly & Sons in Chicago. Previously, Jeffrey was VP for corporate development.

New digs: We hear that **Charles Freeman** is building a house in Hood, Va., where he's operating his own software consulting firm, specializing in consulting for the medical aviation industry.

New directions: After completing an MD/PhD at Washington University and an internal medicine residency with Endocrine Fellowship at Brigham and Women's Hospital, **Mark Behlke** is now back at the Institute doing a post-doc at the Whitehead. Mark tells us that he and his wife, Pat, had their first

ProNet really paid off for me. Although I wasn't in the job market when I signed up, I explored an opportunity that was presented, and I ended up in a great new position. I can't think of any reason why someone wouldn't join ProNet.
Marc Jorrens '89

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child, Lauren Marie, born last August, and that they enjoy being parents very much.

New families: Speaking of parenthood, **Lorenzo Sadun** lets us know that he and his wife, Anita Glazer Sadun, had their first daughter, Rina Ellen, in April 1992. . . . **Wayne Seltzer** has been doing more than skiing in Boulder, Colo. He and wife, Jackie, had a son, Alan Myland, in January 1992. He's almost outgrown the MIT bib that was a gift from **Susan Cohen**. Wayne further reports that he's a software engineering consultant these days, and appreciates the flexibility. His wife has her own business as well: she's a speech-language pathologist in private practice. Oh yes: Wayne can be reached by e-mail at seltzer@sda.com.

New duos: **Richard Valicenti** was married in May 1992, and is now working at the Mallinckrodt Institute of Radiology at Washington University in St. Louis. . . . Last November, **Jeremy Barkan** tied the knot with Lisa Kohan in a ceremony overlooking Jerusalem. . . . **Eric Buckman** is now engaged to Leslie Schwartz of Los Angeles, and is planning a May 1993 wedding. He's finishing up a finance and management degree at Wharton, where he also keeps in touch with **Lew Bender**. . . . And from Silicon Valley we hear that **Anitta Bliss** is now managing Apple Computer's new Duo Dock docking station, a position which has sent her traveling to Italy, Japan, and Canada during the past year. (Alas, her last cat, Sneakers, ran away because of all her traveling, so she hopes to keep her new cat happier this year.) The system is part of the new Duo portable computer line. Anitta had plans to return to the Institute this past February to do some recruiting and visit old friends.

New methods: **Joseph Molitoris** is working at the Center for Naval Analyses and living in Alexandria, Va. His paper on using computer projects to help teach undergraduate physics was published in the September 1992 *Journal of College Science Teaching*.

New ballgame: It's an active life for **Donald Jones** and wife, Ruth (Wellesley '81, Sloan '87) who are playing on numerous soccer teams indoors and outdoors. The World Cup will probably consume all of their vacation time for the near future. Donald's also an "F" certified coach, meaning he's well qualified to coach 8-year-olds.

New appreciation: The chemical engineering students at the University of Connecticut have chosen **Luke Achenie**, professor of chemical engineering, to receive the third annual Rogers Corp. Outstanding Teaching Award. The award recognizes those professors who display outstanding accessibility, approachability, concern for students, present well-prepared and stimulating lectures, and make classroom material exciting. Luke tries to make his classes exciting "by interjecting a bit of humor," he says. Luke joined the UConn faculty last year.

New adventures: It was nine weeks of exotic locales for **Todd Sherman** and wife, Coco, last fall, including the South Pacific, Indonesia, Thailand, and Nepal. Todd's now living in Seattle and working for Silicon Graphics.

New, useful, and unobvious: **David Powsner** became a partner at Lahive & Cockfield, a Boston law firm specializing in patent, trademark, and copyright law in January 1992. He and wife, Susan, keep busy cooking and playing classical music: they're both bassoonists. They also tell us that they see **Jim Ong** relatively often.

Thanks to all who've written lately.—**Mike Gerardi**, secretary, 21206 Glenmoor Dr., West Palm Beach, FL 33409, (407) 655-5050 (w), (407) 683-4003 (h)

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Please send news for this column to: **Helen (Fray) Fanucci**, secretary, 502 Valley Forge Way, Campbell, CA 95008, CIS 74005,744 (or internet 74005.744@CompuServe.COM)

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10th Reunion

I regret to inform you of the sudden death of **John DeRubeis** on Friday, February 19, 1993. John was piloting his airplane when it went down in the Vermont mountains near Lake Champlain. John leaves his mother, Connie DeRubeis, two sisters, and two brothers. As many of you know, John contributed a great deal of time and effort towards the Class of '83 and MIT. He served as our secretary for the first five years after graduation and at the time of his death, he was serving on the MIT Corporation's Visiting Committee for the Department of Athletics, Physical Education, and Recreation. He also served on the corporate executive board of the U.S. Bobsled Team and was chairman of the corporate advisory board for the *Cambridge Review of International Affairs*. John also served on our Class of '83 10th Year Reunion Committee, as well as the Reunion Gifts Committee. John was a member of Delta Upsilon, and, I believe, participated in the track and football teams at MIT. His energy and his service to the MIT community will be missed.

I also regret to inform you of the death of **Larry Dunn** on November 21, 1992, at Beth Israel Hospital in Boston. Larry was a Baker House resident while living at MIT, and most recently had been living in Fort Worth. No other details were provided.

Susan Feindt provided us with the following information at a recent 10th Reunion planning meeting: Susan married **Mike DeLaus**, '82, in Florida last April. They both work at Analog Devices in Massachusetts as process development engineers. The best man was **Bill Tsacoyeanes**, '83. Bill is married, working at Draper Labs, and just had a baby girl in December. **Anne Ko** and **Virginia (Ginger) Harper** were bridesmaids. Anne received her MBA from Wharton in 1988 and is currently working in New York City as a management consultant for Cresap. Ginger has been working as a lawyer for Haight Gardner Poor and Havens in New York City doing aviation litigation since she graduated from Cornell Law School in 1988. Susan also reports that **Anne Tulinsteff** graduated with a PhD in 1991 and is currently working for JPL in Pasadena. **Kim Ramsey** is married with two children and lives in Pittsburgh and is working with her husband a new start-up consulting business. Other alumni attending Susan and Mike's wedding were **Jim Wilbur**, '81, **Doc Williams**, '79, **Herb Stortz**, '79 and **Ken Howard**, '77.

Benson Louie writes that **Yvonne** and he are expecting their first child in February of 1993. The Louies are living in Fresh Meadows, N.Y. . . . **Jerry Rau** writes that he was married to **Karen Woolf** in August 1992. The couple honeymooned in Italy and Greece. Jerry is currently group marketing manager at Synopsys, which had a successful IPO in 1992. Jerry also notes that he can finally afford a home in California—he is currently living in Mountain View. . . . **Cedric** and **Burunda Prince-Jones** are the doting parents of **Kamali Dihenbe Prince-Jones**. Burunda writes that parenthood is the greatest joy and a big challenge. . . . **Bruce Klein** writes that he is a "ticket broker" (scalper) in the New York City area. Bruce invites anyone who needs sports, theater, or

concert tickets to call him at 800-422-TIXX. . . . Lastly, reports from the West Coast indicate that **Ken Krugler** will be "tying the knot" this fall. Ken will marry **Chris Duff**, a California transplant from Harvard, Mass. An October wedding is planned in California.

Hope to see you all at our 10th Reunion.—**Jonathan Goldstein**, secretary, c/o TA Associates, 45 Milk St., Boston, MA 02109

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Natalie Lorenz took a two-week Thanksgiving holiday with her mom who is living on Hawaii's Big Island. She was with her boyfriend, and they watched the sunrise over Haleakala on Maui and then rode mountain bikes down from 9,000 feet to about 1,500 feet in 28 miles. (Okay, how many of you honeymooners have done this? We did, **Cruiser Bob**.) Lots of fun! They also saw an active lava flow at the Kilawea Caldera on the Big Island from about 50 feet above. . . . **Greg Hughes**, a fine software engineer, is a second-year student at Stanford Business School along with fellow '84ers **John McCrea** and **Michael Cation**. Before B-school, Greg ran a small computer company, Granite Microsystems. Greg celebrated his second anniversary this past December to Paula (Vannorsdall), a native of the LA area. Greg says life in the Bay area is great! Surrounded by Fiji friends: **Carlos Ferreira**, '85, **George Zachary**, '87, **Lyle Tripp**, '85, **Mike Donohue**, '87, **Aurelio Peccei**, '87, **John Newton**, '85, **Alan Williams**, '85, **Andreas Judas**, '88, **Jim Cherry**, '78, and **Malcom Fairbairn** (these guys should start up an alumni fraternity house).

I caught up on some news at a Super Bowl party. **Eric Siegler** is working at HP in the Boston area and was married back in 1986 to **Karen Plonty** who works for AT&T. They collaborated on daughter Sarah, who is 2 years old. . . . **Esther** and **Eric Alani** took a trip to Illinois and saw **Nancy (Schuster)**, '87, and **Vinny Natoli** and 6-month-old daughter **Mary**. Mary is practicing for the Michael Jordan look-alike with her tongue sticking out. **Vinny** is moving towards finishing a PhD in physics at Champagne-Urbana. On the same trip, **Eric** and **Esther** also stopped to visit with **Janet** and **Neil Kavesh** and son **Mark** in St. Louis. Finally, congratulations to **Esther**, who is completing a PhD in cell biology.—**Howard Reubenstein**, secretary, 28 Mitchell Grant Way, Bedford, MA 01730, (617) 275-0213 (home), hbr@mitre.org.

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Hi Gang! It's been a long time, and let me apologize for the confusion that has led to a couple of empty columns. Your faithful class secretary had been doing quite a bit of traveling, and it was pretty hard to track him down for the class notes deadlines.

Several MIT alums crossed paths with yours truly over the last half year. **Sheila Davis**, **Kathy Lin**, '86, and **Sam Pullen**, '89 were in Japan this summer participating in the NSF Summer Institute in Japan for U.S. graduate students. Sheila is an MD-PhD student at Penn, while Kathy is an MD-PhD student at University of Illinois. Sam is a PhD student in aeronautical engineering at Stanford. Also in Japan was **Jon Genka**, '84, who is working for Microsoft in Tokyo and still using his private pilot's license.

Right: Friends from New House helping to celebrate the wedding in Pittsburgh last August of Al Can-gahuala, '87, and Maria Elisa Rey of Bogota, Colombia (from left): Jennifer Alpert, '92; John Tewksbury, '94; Debbie Wells, '92; Lalit Jain, '90; Maria and Al; Ravi Soundararajan, '92; Gloria Huang, '91; Mark Brandreth, '94; Deanna Hiltner, '94. Present but not pictured were Orlando Martinez, '91, and Jack and Lisa Prior, the Spanish House tutors.



Left: Friends from Chi Phi (from left): Carrin Culotta; Mark Culotta, '85; Phil Paoletta, '86; Phil Soo, '84; Isabelle Paoletta; Bill Irving, '87; Barbie McConnell; Craig McConnell, '88; Cyndi Downey, '90; Eddie Hernandez, '90; the bride and groom; Pat Aitchenson, '87; Ellen Duffy; Mark Thurston, '86; Dave Kemper, '87; Dave Schultz, '87; Jayant Sharma, SM '89; Xavier Douwes, '90; Anthony Joseph, '88.

Several other alums were spotted around America this fall. Mike Agronin, '84, and his wife, Ellen, are the proud parents of their daughter Elizabeth born in August 1992.

Lora Silverman and husband Keith Stolzenback are the proud parents of a beautiful black labrador retriever. . . . Julia White, '87, is living in Seattle, Wash. . . . Laura Lesniewski, '84, is working as an architect in Kansas City, Mo., and works part-time for Habitat for Humanity. . . . Don Gillies, '84, and Laura Kotovsky have almost finished their respective PhDs at University of Illinois at Urbana/Champaign. . . . Gerry Gleason, '83, is living in the Chicago suburbs. . . . Susan Zarzeczny, '87, is doing statistical research on AIDS. . . . Monica Alcabín, '83, is working for MITRE in Virginia. . . . Gail Gordon is working for MITRE in Massachusetts and is now engaged to fiancé, Luc, who is from France.

And now news from the Alumni/ae Association mailbag. . . . Sara (Keagle) Cooke and husband David, '83, had their second daughter, Hallie Rebecca. . . . Peter Tzanetos was recently engaged to MaryRose Helwig of West Hartford, Conn. Peter also left Aetna in Hartford to join Citicorp in New York City. . . . Robert Watkins is a PhD candidate in physics at University of Maryland. He is also an independent filmmaker. Any other MIT alums at UMaryland, he asks?

Eric Ristad is an assistant professor of computer science at Princeton University and a recipient of the prestigious NSF National Young Investigator Award for his research on the computational theory of human language and on human handwriting formation and production. . . . John Ragan started his first "real" job as a research scientist at Pfizer Central Research in Groton, Conn. He is working with the inflammation project team trying to discover new carbohydrate-based drugs to treat arthritis. He figures on about 30 more years before the project takes on an added personal dimension. . . . Jeff Chang is a software engineer at Claris in the Japanese Software

Development Group. He has become a great fan of San Francisco since he moved to the Noe Valley section of the city. He was planning to travel to Hong Kong and Thailand over Christmas break.

Roberto Engels and wife, Marina, are expecting the first of many. . . . Everett McKay married Marie Seguin of Hemmingford, Quebec, on October 3, 1992. He is working as a software engineer for Sony Electronic Publishing Co. from his home in Alburg, Vt. . . . Michael Candan took part in the NYC alumni/ae telethon on October 22 with an enthusiastic bunch of people including Sara Bingman, '84, Buckley Yung, '89, and Nicola Bird, '91. . . . Peter Quigley delivered the 11th Robert Bruce Wallace Lecture in October. . . . Mina Park Fader and Pete Fader, '83, had a baby girl, Shayna, on October 17.

Inge Gedo is still working on a master's degree in international affairs and tutoring elementary school. Husband Apple has been a hard-charging captain by day and an entrepreneur by night with his new company AI Management Consultants. . . . Tom Lecompte worked for McDonald's Corp. for one year after graduating. He then entered Northwestern University and graduated with a PhD in physics. He now has a postdoc at University of Illinois at Champaign/Urbana working on an experiment at Fermilab. In his spare time, he plays trumpet in a wedding band. . . . Stewart Cobb left the Air Force in August 1991 when it began to seriously interfere with his addiction to graduate school. He earned a master's in aeronautics and astronautics in June 1992, and he is now in the PhD program. He has about five years to look for a 12-step recovery program.

Sadly, I must report the death of one of our classmates. Dimitri Kazarinoff died in November 1991 in Albuquerque, N. M.

This month the class members randomly selected to submit news are: Jay Elson, Dan Beyerbach, and Jill Porter. . . . Your faithful secretary is now a professor of mechanical

engineering at Carnegie Mellon University. Please send research grants and news to Bill Messner, 5927 Alder St., Pittsburgh, PA 15232, (412) 361-4180

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Please send news for this column to: Mary C. Engebret, secretary, 21305 Arrowhead Ct., Ashburn, VA 22011

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Y'all did well this month—five notes via the alumni/ae office and two e-mails. Thanks, and keep it up!

Kevin Hurst writes: "After completing four years in the U. S. Navy, I started grad school at Georgia Tech in the summer of '91. I am working on a doctorate in the area of power electronics." Kevin reports that he's been happily married for about six months. . . . Coleen (Barry) Smith is currently attending graduate school at Georgia Southern University, where she is working on a master's in mathematics education, which she plans to finish within the next year. Besides her actual schoolwork, Coleen is kept busy by her commute (160 miles round-trip from her home in St. Simons Island, Ga.), her work as a lab assistant in the school's academic computer system, and by her husband Doug, '86, with whom she vacationed in Holland for two weeks this past fall. (Actually, I wonder who in our class has the longest commute? If you can beat 160 miles round-trip, write and let us know. As of right now, Coleen is the official Class of '87 record holder!) . . . Kimberlyann (Chasteen) Bowmer married her husband, Doug, in November 1991. She is currently working as a patent attorney at NASA Langley Research Center in Hampton, Va.

After spending many years as a strategic planning consultant at the MAC group, and after a couple of years as an independent consultant, **John Slater** writes that he is now working for Apple Computer in their Channel Development Group. . . . **Christopher DeBlois** writes: "After completing an SM in structural engineering in 1989, I married Maureen Reiling (Wellesley '87), and headed to the warmth of Atlanta to build skyscrapers. I've since discovered a fondness for residential projects. I'm with a two-man firm designing and inspecting houses, and I contribute to *Fine Homebuilding* and *The Journal of Light Construction*." . . . Over Internet, I got a note from **Greer (Tan) Swiston**, who married fellow classmate **Rob Swiston** last June. Although she didn't say, my records show that Greer works as a software engineer for Xerox. From their home in West Newton, Greer and Rob report that they stay in close touch with **Toai Doan** and **Stanley Oda** (who both work for Digital Equipment in Marlborough, Mass.), and **John Canfield** (whenever he is in the country). They also recently saw **Eugene Pan** (who works for KSR in Waltham) when he came by for their Super Bowl party. Greer was recently elected president of the Boston section of the Society of Women Engineers, and is also involved with several Asian-American organizations in the Boston area.

Finally, **Jerry Hershkowitz** says: "I'm beginning to get adjusted to life deep in the heart of Texas. While on a business trip to San Jose, I had dinner with **Matt Richter**. He's working towards a PhD in astrophysics at Berkeley and gets to go to Hawaii under the guise of research from time to time. The biggest thing in his life, however, is his upcoming wedding in July to his fiancée Susan, whom he met at Berkeley." . . . Thanks again for all your help with the column!—**Jack Leifer**, 2703 Swisher St., #202, Austin, TX 78705, (512) 472-7507, email: leifer@ccwv.cc.utexas.edu

88 5th Reunion

First off, a reunion update from **Lisa Martin**. The class of '88 Reunion is only a month away! We know many of you have already made plans to attend. So call your friends! Don't be left out! You may register for events through mid-May. The following is a run-down of activities you won't want to miss. **THURSDAY, JUNE 3:** Tech Night at the Pops. **FRIDAY, JUNE 4:** Technology Day and Luncheon where our 5th Year Reunion Gift will be announced. At night, the Class of '88 bash! **SATURDAY, JUNE 5:** Reunion Challenge Games and "techsas" BBQ. At night, dining and dancing with the Class of '83 and '78 at the World Trade Center in Boston. **SUNDAY, JUNE 6:** Class of '88 brunch and election of new class officers. Thanks to those of you who sent in class dues—they help to cover the cost of our mailings. You should be receiving your class directory shortly (if you haven't already).

By now you should have received a ballot with nominations for class officers. The actual election will be held on the Sunday morning of reunion weekend. Anyone who will not be present on Sunday morning may submit the ballot through the mail. Nominations may also be accepted in person at the election on Sunday morning, but obviously these people will not appear on the ballot. If you have any questions, please contact **Jim Casamento**, our nominations chair, at the address below.

We are well on our way toward meeting our goal for the Class of '88 Gift! But we're not

quite there yet. Much thanks to those of you who have donated—remember, if you've made a pledge, we must receive your donation before June 1 to include it in our Reunion Gift. If you haven't yet donated, please consider giving at least something. Don't forget that donors of \$100 or more will receive a handsome barrel bag. So don't miss out!

Since this is the last column before the reunion, **Lisa Martin** personally thanks (in advance) **Jocelyn Koehler**, **Sheila Neville**, **Christine Chu**, **Don Reiz**, **Jim Cadamanto**, and their committee for all the effort and time that has gone into planning our reunion and reunion gift.

Finally, if you have general questions about the reunion, reunion gift, or nominations procedures, you may call **Susan Tomases** at the alumni/ae office, (617) 253-8216, or write to us: Class of '88, The Association of Alumni and Alumnae of MIT, 77 Mass. Ave., Room 10-140, Cambridge, MA 02139-4307.

Now onto some class news. **Peter Schmidt** writes about the company he has founded, **Midnight Networks, Inc.**, incorporated as of August 1, 1992. They have an office on Rte. 128 in Waltham, and have been doing consulting at Polaroid, Reebok, DEC, Stratus, et al. to fund their software development. There are three employees, including Peter, all MIT grads, and **Hollie** is running their business systems in the evenings and on the weekends. Their first product was due to be released in March 1993. Things are looking good so far and Peter is enjoying being a company president...it "makes the 14-hour days fly by!"

Lt. Chris Cook returned in November from a six-month deployment at Sigonella, Sicily. He flew several missions out of Jeddah, Saudi Arabia, and Daman, Turkey. He and his wife, **Kathy**, had their second child in January.

Scott Lichtman is attending Harvard Business School and having a great time. He sits across from **Ryan Fong**, '87, **Jamie Goldstein**, '89, and **Christy Alvord**, '90. . . . **Sean Beausoleil** graduated from Emory Business School in Atlanta in May 1993. He will then return to construction project management as a project manager. . . . **Joe Morgan** wants all his classmates to know that he moved to Pensacola, Fla., to work for CNET (Chief of Naval Education and Training). He looks forward to arelaxing two years in the sun.

That's all folks! Hope everyone is doing well and I'd love to hear from you!—**Grace Ma**, secretary, 155 East 29th St., #32H, New York, NY 10016, (212) 447-1925

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The mail gets leaner and leaner every month. Please please write and send in pictures for our calendar! Here are this month's list of people to please write in: **Karen Chenausky**, **Michael Griffin**, **Kevin Maguire**, **Nina Ross**. What are y'all up to? If anyone knows about any of these people or anyone else, write in!

The only piece of e-mail I received this month came from **Vincent Chau**. Vince, who is in his fourth year of med school at UChicago, writes: "Graduation is only five months away (June 11). I've decided to go into anesthesiology, so I've been interviewing for residency positions all over the country. In November, I drove cross-country from Chicago to San Diego to spend a month doing an anesthesia rotation at UC/San Diego. While I was in California, I saw many MIT people. I stayed with **Chris Rehmann** and **Rachel Duncan** for a few days. Chris is pursuing a PhD in

civil engineering at Stanford, and **Rachel** is in the PhD program in chemistry there. I also got together with **Sam Hou** (PhD in electrical engineering at Stanford), **Brian Murphy** (PhD in computer science at Stanford), **Scott Geels** (master's in electrical engineering at Stanford), and **Mike Malak** (PhD program at Caltech). In addition, I got together with **Stacey Rogers** (finishing up U.S. Navy obligations), **Steve Pao** (working at Oracle), and **Phil Kuhn** (also working at Oracle). The month in California was a lot of fun. The weather held up at the beginning of my stay but the rainstorms came during my last week there.

"At the beginning of December, I started my trek back to Chicago via the Grand Canyon and Texas (to avoid the snows in the Rockies). I got back to Chicago for a day and then continued on to the East Coast for more interviews. I stopped in Pittsburgh to see **Andrew Tomkins**, who is getting a PhD in computer science at Carnegie Mellon. Then I went to UVirginia and then up to Baltimore for an interview. There, I stayed with **Suphy Chen**, who is a fourth-year med student at Johns Hopkins. She's planning on going into dermatology. It just so happened that **Anjali Arora** was visiting the same day since she had an interview in Baltimore, too. Anjali is a fourth year med student at UMDNJ who is planning to go into pediatrics. **Anu Vedantham** (she's married now) tagged along with Anjali for the ride. The three of us got together with **Parag Patil** for dinner one night. Parag had spent two years in England as a Marshall scholar and is now a second year med student at Hopkins. I also spent some time with **Matt Machlis**. He's working at Orbital Sciences in Fairfax, Va."

After Vince's trip to Baltimore, he drove home to Liberty, N.Y., and spent the holidays with his family. Then just before New Year's, Vince drove back to Chicago, putting about 13,000 miles on his car in about two months. Vince says that he "probably won't do that again for a long, long time."

Kai-Yee Ho is living in Chicago working at Swiss Bank. He's also a part-time student at UChicago Business School. . . . **Gigi Hamad** is a fourth-year med student at Hopkins and is planning to go into plastic surgery. . . . **Mike Lam** is a classmate of Vince's in Chicago. Mike will be going into internal medicine. . . . **Cindy Wang** is pursuing the PhD portion of an MD/PhD at Harvard Med School and lives in MacGregor as a floor tutor. . . . **Curtis Eubanks** is still at Sony in Japan. He's planning to visit the U.S. later this year.

Isako Hoshino is at MIT getting a PhD in materials science. . . . **Jonathan Maltzman** is currently in his fourth year of the MD-PhD program at UPenn School of Medicine.

That's all the news I have for now. Thanks to Vince for providing almost all the news in this article!—**Henry Houh**, secretary, 4 Ames St., Cambridge, MA 02142, (617) 225-6680, e-mail: tripleh@athena.mit.edu or henry_houh@mit.edu

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Ken Bergenthal is now handling product line issues and marketing responsibilities at Oracle Japan. Besides working, Ken has been having a lot of fun meeting up with MIT alumni/ae. Last December, a group of about 40 alumni/ae gathered in Tokyo at Christmas. Ken went power skiing in northern Japan with **Peter Berkelman**, '92, and some others. And back in August, Ken climbed Mt. Fuji and watched the

sun rise. . . . On August 15, 1992, Penny Plummer and Andrew Fusco were married in Fort Worth, Tex. Several MIT classmates were in attendance. Kristin Slanina, '91, was maid of honor. Christine Bald was bridesmaid, and Kevin Fahey, '92, and Harald Quintus-Bosz were ushers. Also at the wedding were Jennifer Hamel Jones, Matt Katz, Scott Sikora, Erik Burgess, Aaron Flores, '91, Monica Dodds, '93, and Mike Falcon, '93. For their honeymoon, Penny and Andy spent 10 days in Hawaii, including four of those days visiting the islands in a cruise ship. Penny and Andy's wedding festivities continued again on labor day when Andy's parents hosted a reception in the Washington, D.C., area. MIT alumni/ae at that party included Mike Murray, Tom Sacoman, Craig Pastrone, Krista Beed Pastrone, '89, Matt Katz, Bob Dunlay, Dennis Gonzalez, '92, Jim Harrison, '88, Tim Collins, '89, Mike Doane, '92, Beth Pruitt, '91 and Rod Brown, '88. Penny and Andy have now settled down in northern New Mexico where they both work at Los Alamos National Laboratory. Penny recieved a master's in mechanical engineering from Stanford in April 1992, and Andy received a master's also in mechanical engineering from MIT in 1991.

Mathew "Joe" George, Jr., received a master's in June 1991. He is now an application engineer in the Digital Signal Processors Group at Texas Instruments in Houston. Joe mentioned that the company is doing well and would be interested in speaking to anyone who has any DSP experience, especially with TMS320. Joe can be reached at jgeorge@lobby.ti.com. Joe's job has taken him all over the country, including San Francisco, Denver, and Boston. During Mardi Gras last year, Randy

Duran and Rafael Vidaillet flew into Houston to meet up with Joe and then drive out to New Orleans. They had a great time and plan on making the same trip again this year, only with more people!

Joanne Spetz is planning to teach economics at Stanford over the summer. She's currently a TA for another class at Stanford. In late February, Joanne will be presenting a paper she wrote on the laser in medicine (with an economic history focus) at a medical technology conference. The paper will also be published in the *Institute of Medicine* at the end of the summer. Besides being busy at school, Joanne keeps busy as VP of young alumni/ae events for the MIT Club of Northern California. She was also an educational counselor this year, interviewing high school seniors for the MIT Admissions Office.

Cindy Shen and Rick Franklin, '89, are engaged. Cindy is at the University of Maryland Medical School doing rotations, and Rick is at an Air Force base in New Jersey flying C130 transports (or is it C140s?) He also did some support flights in Africa for Operation Restore Hope over the holidays. . . . Tom Knight has also recently announced his engagement. Tom has been working for Alcoa in Pittsburgh. He's had some time to do some traveling. Recently he circumnavigated the globe with Eric Soederberg, SM '92. . . . Micah Adler is in Berkeley's computer science PhD program. . . . Brad Drotar and his wife, Dee, are living in Colorado with their baby, Sydney Ariana. . . . Alison Lynch is with the Teach for America program in New York City.

That's all the news for this time. Please send news.—Ning Peng, secretary, 305 Memorial Dr., Cambridge, MA 02139 or ning@athena.mit.edu

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"Hello!" writes Susan Jackson. "I am presently at Johns Hopkins medical school in my second year, and I'm even starting to enjoy medical school." Susan will marry Gary Quick in June. Gary is working for Shell Oil as a process chemist, in Houston, Texas, and Susan hopes to transfer to Baylor's medical school, which is also in Houston. On the fascinating postcard Susan sends of the "Texas Medical Center," she says, "I have also joined the Air Force, so I am Second Lieutenant Jackson. I will work for them as a doctor for four years after my residency. I hope to go into ophthalmology."

Jean Sumida sends news about a bevy of classmates with whom she recently visited. Jean has been working for an MPD in Portland, Ore., since fall 1991. She works in the systems section doing travel demand forecasting. "Currently," writes Jean, "I am working on an air quality conformity project, forecasting the amount of pollutants emitted by auto traffic in the region." On a trip to New York City, Jean stayed with Amanda Lam, who works at Banker's Trust, at Amanda's home in Bayside, and was able to see several classmates. She sends news that Mark Hochberg is working with First Boston, and that Manich Bapna, who works for Oliver Wyman, left for an assignment to London in January. Jean spent the rest of her visit to the Big Apple with Andrew Alleman and his family. Andrew was on holiday from graduate school in electrical engineering at the University of Washington. Mike Leary, who is doing electrical engineering graduate work at Cornell, drove down to see Jean and Andrew one afternoon. Andrew and Jean also met with Peter Hinze, who is in MIT's graduate program

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for mechanical engineering, and **Robin Prasad**, who is at McGill for medical school. They all saw "Lost in Yonkers" and had dinner at the Hard Rock Cafe.

Congratulations to **Mark Lundstrom**, who is among this year's prestigious Rhodes Scholars! Mark is currently at the Sloan School and, according to *Tech Talk*, plans to study political science at Oxford. . . . **Andrew McGuire** completed the Navy's basic surface warfare officer's course in December. . . . **Donna Khodarahmi** is in her second year of medical school at the University of Pennsylvania. "I am trying to make sign-language a permanent elective in our curriculum after organizing and participating in a medical sign-language class for my classmates." Good luck, Donna! . . . **Rob Nunez** is working for Spectrum in Boston. Rob and I spoke at a recent party and he said he is also busy starting his own software mail order business. Although getting the business off the ground takes a lot of his time, Rob enjoys it because his initial line of software includes computer games.

Jessica Im and **John Sadler**, '87, share an apartment near UC/Berkeley, where Jessica attends graduate school. . . . **Praveen Saxena** spent New Year's with Jessica and John along with many other MIT alumni/ae in New York City. Praveen shares a Philadelphia hi-rise apartment with Jon Goetz, '92, Andy Karduna, '89, and Jimmy Kunihiro, '88. . . . I spoke with **Prasath Krishnawswamy** and **Grant Murray** at an Allston-Brighton party with several party-goers from both MIT and BU Law. Prasath is doing his mechanical engineering graduate work at MIT and is the district director of Tau Beta Pi. He hopes to begin working on his thesis soon. Grant is doing finance-related work with Wyatt, Co., in Boston.

Thank you to all who have sent news recently! I hope to hear from the rest of you very soon! Please write to: **Andrew Strehle**, secretary, 12 Commonwealth Court #10, Brighton, MA 02135, (617) 232-2261

92

First, I'd like to apologize for missing the column in last month's issue of the *Review*. I had just recently moved and was not receiving my mail soon enough for me to meet the deadline. This month though I have an abundance of news to report thanks to the many of you who wrote in.

Congratulations are in order for **Rachel Huggins** who was married to Ensign Hilary M. Thornton, USN '91, on May 9, 1992. Rachel is attending the Chemical Engineering Practice School at MIT to complete a masters degree. . . . **David Sherrill** and **Amy Whiteman Sherrill** were married on August 1, 1992. Amy is working on a master's degree in chemical engineering at Georgia Tech, and David is working on a PhD in chemistry at University of Georgia's Center for Computational Quantum Chemistry. . . . **Jennifer Caulfield** is in Ecuador where she is working as a volunteer with the Peace Corps. She began her 28-month stint last August. She is earning \$200 a month working as a water and sanitation engineer. Jennifer passed up an assistant research position at MIT for this opportunity. She says, "It just seemed with the Peace Corps, my education would be all for the good, for the positive, making a difference." It is wonderful to hear that our classmates are holding onto their ideals and supporting noble causes.

After graduation, **Sande Chen** traveled for

the summer and had the chance to visit a few of our classmates and other alumni/ae. She saw **Karen Tung**, '90, in Austin, Tex., and then went to L.A. where she stayed with **Tzu-Jun Yen**, who is now working for Gillette. From L.A., Sande flew to Taipei, Taiwan, to participate in the 1992 Study Tour and Language Training Program for Overseas Chinese Youth. **Irene Chow** was in her group. The group toured Taipei as well as the southern and eastern parts of the island. From Taipei, she flew to Bangkok, Thailand, to see **Sornprapa Jaisanit**, who is considering teaching economics in a university there. Next, Sande went to Singapore to visit **Lena Lin**, '91. Then, it was on to Malaysia to meet up with **Khaliza Md Khalid**, who is now in Kuala Lumpur working for SeaCorp-Schroder Capital Management. She returned to Singapore to help **Tzu-Jun Yen**, who had come to give an MIT presentation at her high school. Finally, Sande returned to the United States and visited with her brother, **Curtis Chen**, '89, in San Francisco. Now, Sande is living in London, where she is pursuing an MS in economics at the London School of Economics and Political Science. **Kishwar Ahmed** is also in the program.

Rahul Shah is working at Monitor Co., a strategy consulting firm in Cambridge. Monitor is trying to recruit more people from MIT, so if you're still searching for a job or know someone who is, check it out. . . . **Rizwan Virk** is working in Cambridge in the Database Management Department at Fidelity Investments. . . . **Sandy Vasan** is in the Harvard/MIT HST medical program, and **Sima Doshi** is at McGill Medical School in Montreal.

More congratulations go out to our classmates who are graduates this year. **Jon Clay** finished a double major last term in cognitive science and mathematics, and **Monique Lawrence** stayed on for an extra semester to take premed. requirements since she has decided to veer from chemistry and head into medicine. Also, there are a number of people involved in the 6A program and EIP who returned to finish their theses this spring.

Gregory Teran received a \$500 first prize award for excellence in the annual literary competition sponsored by the Alpha Delta Phi International Fraternity. He was honored for his group of poems, "Crosscountry." Another winner was **Sheeyun Park**, who shared second place in poetry for "A Trip to the Country," and honorable mention for his poems, "My Father's Legacy" and "Fireworks."

Albert Cheng is working in Seattle at Boeing as a materials and processing engineer in the Military Airplanes Division of the Defense and Space Group. Wow! That's quite a job description. Hope you're seeing some sunshine out there Albert! . . . **Grace Koo** writes from New York that she is working for Bankers Trust on the trading floor of their downtown office. She informs us that **Kevin Carl** is also in NYC at J.P. Morgan Investment Management, and **Mursaleena Islam** is at Syracuse University working on a PhD in economics. . . . **Luis Maas** went to Paraguay for Christmas break and then wrote part of his doctoral qualifiers in January. He says, "HST is going great. I really love it. Grad school's tough, but I like the intensity." There's a hard-core type for you. You'd never guess where he went to school, would you? He tells us that **Chris Doehler** went to Germany on an exchange program in the fall but came back to Boston in May.

Another one of our happy summer travelers was **Julie Bourne**. She and **George Christopher**, '91, toured the western U.S. by Ford Bronco for two and a half months. They camped out in national parks for the most

part but allowed themselves to hit civilization once in a while to sightsee and visit MIT friends in San Francisco and Seattle. Among the over 17 national parks, monuments, and seashores they visited, Julie writes that Rocky Mountain National Park, Sequoia National Park, and the Olympic Rain Forest were her favorites. She is now living in Pittsburgh near the CMU campus and is working as a computer programmer for a very small company. In the fall, she hopes to attend UPenn graduate school to study natural language processing and to pursue a PhD.

Joe Melvin, who is working in Cincinnati as an R&D engineer for Procter and Gamble says, "I spend most of my time fighting off the boredom that pervades southern Ohio. God, how I miss Harvard Square!" (Gasp, he doesn't miss Tech Square?!) . . . **Andy Parsons** is working for a biotech company called Millipore in Bedford, Mass. His plan is to work for a few years, then do graduate-level biology studies at UColorado at Boulder since they have some great researchers, great skiing and bicycle terrain, and a medical school to boot. Lack of school work has left him with more time to dedicate to his favorite activity—racing of all kinds: running, biking, rollerblading, biathlons, and triathlons. Andy says there are just some things he'll never miss about MIT, but that may be because he's living the college lifestyle with a bunch of his Theta Xi brothers in a house in Somerville where the TV is usually blaring and there's good home cooking on the stove—believe it or not!

I spent the winter in Aspen, Colo., where the skiing was great and the atmosphere very laid back. I may spend the summer there as well for some more intense outdoor experiences—hiking, running, climbing. Lots of celebrities in sight here, but I'd have been more excited to bump into some MIT peers. That's it for now folks. There's lots more to tell and even more for me to hear from all of you, so keep in touch and stay tuned for our next column. If you're trying to contact any MITers, I'd contact the Alumni/ae Association until we get our class directory out. We hope that will be coming along soon, but it's another project that needs your help. Let us know where you are and if you'd like to do some work for the class.—**Leslie Barnett**, secretary, 56 Brown St., Mineola, NY 11501, (516) 746-4291

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I CIVIL AND ENVIRONMENTAL ENGINEERING

Ulrich Lascher, SM '59, ScD '63, sends word from Orinda, Calif.: "I was promoted to corporate senior consultant at Woodward-Clyde Group, Inc., where I recently celebrated my 25th anniversary. The Corporate Senior Consultants group of 7 senior principals, highly qualified in both technical and management areas, is a novel way of taking best advantage of senior personnel in the firm."



Richard Ladd

Richard S. Ladd, SM '66, VP of Woodward-Clyde Consultants' Edgewater, Fla. group, has been elected to a three-year term on the American Society of Testing & Materials board of directors. Ladd worked at MIT as a research engineer until 1966, when he joined Woodward-Clyde. His main career focus has been in the area of laboratory testing of soil and rock and characterization of soil

properties. He supervises the geotechnical laboratory practice and its integration into his company's engineering practice. Ladd, chair of ASTM Committee D-18 on Soil and Rock, has been active in D-18 since 1971, serving as vice-chair and membership secretary before his appointment as chair in 1990. ... Howard A. Levin, SM '76, writes from Great Falls, Va.: "I founded Synergy Consulting Services Corp., which provides technical and management consulting services for energy production facilities. Synergy addresses engineering, safety, regulatory, financial, and performance challenges associated with the design, construction, and licensing of nuclear power plants and other major generating facilities." ... News from John Uppgren, SM '85: "My wife, Melissa, and I recently bought a home in Stillwater, Minn. I am currently an account manager for NeXT Computer and responsible for corporate sales in Minnesota." ... From Athens, Greece, Nicholas Stathakis, SM '88, reports: "I am project management consultant for MDA (Monk Dunstone Associates), a British-owned project management consulting firm. I am also managing director of Imantex, a Greek importing and trading company." ... Fumiaki Shiroishi, SM '88, writes: "I am engaged in planning the future rail transportation network in Tokyo in pursuit of a higher level of service." ... Richard M. Soberman, SM '61, PhD '63, is chair of the Civil Engineering Department at the University of Toronto. ... Major General Robert F. Seedlock, SM

'40, who lives in Melbourne, Fla., provided assistance during the Hurricane Andrew aftermath. He received two letters of thanks for his generosity during that period. The Platinum Coast Amateur Radio Society used his recreational vehicle to deliver disaster relief, communications equipment, and personnel; and the Rockledge Police Department stationed five officers each night in his motor home in nearby Florida City, a jurisdiction Rockledge "adopted" after the storm. In addition, Seedlock supplied food and other provisions—a generous citizen, indeed! ... Fernand Nicolas De Waziers, SM '77, writes: "After seven years in the States and two in England, I'm now in Belgium in the environment sector. More specifically, I work with new landfills, rehabilitation of old landfills, decontamination of sludges, soil decontamination, and hydrocarbon spills (land and water). I am very interested in knowing what MIT does in this field and/or in contacts with former students who work in the same field (32-2-7313107 phone and fax)." ... Cranston R. Rogers, SM '51, reports: "I am a project manager for the Maguire/Harris Team for design of the largest final design contract for the Central Artery/Third Harbor Tunnel project in Boston (Section DO9A). To put this in perspective, I was chief structural engineer on the design of the Dewey Square Tunnel on the original Central Artery during 1954-55. I was made an honorary member of the BSCE Section of ASCE in '90 and made a life member of ASCE in '90. I was nominated to honorary member of ASCE on November 1, 1992 (subject to review and selection by the HM committee). ... Daniel A. Jost, SM '75, sends word: "I was recently appointed executive VP of Victory International Van Lines, Inc., Staten Island, N.Y., specializing in domestic and international moving of household goods for major corporations. I am responsible for all business operations, sales, and marketing." ... Ernst Basler, SM '57, has been awarded an honorary doctorate by the Swiss Federal Institute of Technology for "his exemplary pioneering work for an ecology-oriented society and his outstanding achievements as a civil engineer and entrepreneur in transforming academic knowledge into practical work." His citation continues: "As an engineer, Basler has consistently applied the measures he had been postulating (i.e., closed circuits, sustainable development, slower turnover of materials) in the building industry as well as in the fields of traffic and energy. At the beginning, acceptance was limited. It needed this inner conviction that, in the long run, only widely based concepts combining the knowledge and experience from various disciplines led to permanent solutions in complex projects." In 1969, Basler spent a year as a visiting professor at MIT, where he started a course of lectures on "Engineering Strategy." Based on these lectures he later wrote *Strategy of Progress: Environmental Pollution, Scarcity of Habitat, and Forecasting Methods*, which was pub-

lished in Switzerland and Germany in 1972.

Daniel L. Schodek, PhD '71, has recently had *Structure in Sculpture* (MIT Press, April 1993) published. A pre-press release states: "This is a book on sculpture unlike any other that has ever been written, and one that has important practical as well as theoretical implications. It lays out the fundamental structural issues of concern to creators and commissioners of sculpture, from balance and geometry to the characteristics of different materials. Schodek illustrates his discussion of sculptural principles with the work of masters such as Auguste Rodin and of contemporary artists such as Richard Serra, Alexander Calder, and Christo."

Lieutenant Colonel John F. Michel, SM '47, died on November 14, 1992. His wartime service, 1941-45, with combat engineer and amphibious units, included a major role in planning the Omaha Beach operation at Normandy. After WWII, he served in several capacities, including chief of the Applied Electronics Branch in the Corps of Engineers Research Laboratory. During 1951-54, Michel was chief of the engineering division at the Joint Construction Agency in France. There he supervised about \$150,000,000 in military construction, such as air bases, hospitals, and depots. He returned to the Continental Army Command in 1954. In 1957, Michel resigned his commission to settle in Miami, where he worked for Rader and Associates in design and construction of urban and port projects in the United States and in South America. He established his own consulting firm in 1960, specializing in construction of subdivisions and marinas, shore protection, and various oceanographic projects. In 1965, on the invitation of the dean, Michel became associated with the University of Miami's Rosenstiel School of Marine and Atmospheric Science, first as a research assistant, then as associate professor in a new division, ocean engineering. He developed and taught graduate courses in the areas of coastal engineering, tidal hydraulics, and offshore operations. After leaving the university in 1976, he continued his consulting business until his final illness. During 1980-83, he particularly delighted in working with the artist Christo and his wife, Jeanne-Claude Javachev, as they developed and completed the project "Surrounded Islands" in Biscayne Bay. He was a member of Sigma Xi and an avid sailor throughout his life.

II MECHANICAL ENGINEERING

Sidney A. Whitt, SM '37, writes from Bozeman, Mont.: "My wife and I live 80 miles north of Yellowstone Park; any ME's 34G venturing near are welcome to a venison lunch or dinner (sorry, no other grads). Son Greg, ME material, is a molecular biolo-

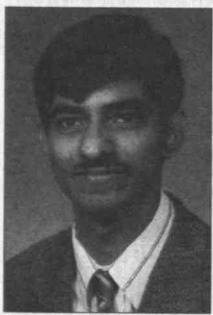
DEGREE CODES

AE	Aeronautical Engineer
BE	Building Engineer
CE	Civil Engineer
CHE	Chemical Engineer
CSE	Computer Science Engineer
DPH	Doctor of Public Health
EAA	Aeronautical & Astronautical Engineer
EE	Electrical Engineer
EGD	Doctor of Engineering

ENE	Environmental Engineer
MAA	Master in Architecture Advanced Studies
MAE	Materials Engineer
MAR	Master in Architecture
MCP	Master in City Planning
ME	Mechanical Engineer
MET	Meteorologist
MIE	Mineral Engineer
MME	Marine Mechanical Engineer
MNG	Master in Engineering

MPH	Master in Public Health
MTE	Metallurgical Engineer
NA	Naval Architect
NE	Naval Engineer
NUE	Nuclear Engineer
OCE	Ocean Engineer
PhD	Doctor in Philosophy
ScD	Doctor of Science
SE	Sanitary Engineer
SM	Master of Science

gist. Son Ward is in math research with Bell Labs. So who can make predictions?" ... **Stephen Hom**, ME '91, is working for 3M in St. Paul, Minn., on new product development. ... From Mendham, N.J., **Werner Engelmaier**, SM '66, reports: "After taking early retirement in 1990 from AT&T Bell Labs, I formed a consulting company, Engelmaier Associates, Inc., specializing in reliability aspects of electronic packaging and interconnection technology." ... **Dwight E. Beach, Jr.**, SM '65, sends word: "I've returned from my first trip to Russia, where we are selling oil tools to the Russian petroleum industry—even made it to Siberia. Russians are sophisticated, they just lack money. I am president of Houston Engineers, which makes oil drilling and production tools and markets them worldwide." ... From Lincoln, Mass., **Thomas A. Blatt**, SM '59, writes: "I founded Intrax Corp. in 1979 to provide international business development services to small and medium-size technically oriented companies in the U.S. In 1989 we established a rep. office in Budapest, Hungary. As of January 1993, we entered an agreement with a major French importer/distributor to distribute products brought by Intrax in the EEC." ... Word from **Michael Dubey**, SM '48, in Van Nuys, Calif.: "Having retired from Lockheed in 1982 and hit the lecture circuit as an expert in systems engineering management, I find little time to practice as a retiree. I'm currently presenting a course sponsored by the California Technical Institute at an aerospace company here in Southern California. Meantime, the children have grown, graduated, left home, and the dog died. You'd think life for a retiree was about to take off! Maybe I'll quit the lecture circuit and write a book instead." ... **John E. Mayer, Jr.**, SM '54, ME '57, ScD '60, reports: "I am professor of mechanical engineering and professor of engineering technology at Texas A&M University, and hold the Allen-Bradley Professorship of Factory Automation. I currently am also the program coordinator for manufacturing engineering technology." ... From Albany, Calif., **Boris Rubinsky**, PhD '81, writes: "I am professor in the Department of Mechanical Engineering at the University of California at Berkeley. I have founded, during the past three years, three successful biotechnology companies. The first of the companies, Cryomedical Sciences, is already listed in NASDAQ and is selling surgical equipment for cryosurgery. The device is used for treatment of cancer in the liver and prostate with good results. The second company, A/F Protein, has its headquarters in Boston and sells unique antifreeze proteins derived from sub-polar fish, under a licensing agreement with the University of California. Galcore, the third company, has production plants in Israel and is producing, under license from the University of California, devices for cryogenic preservation of oocytes and embryos for human and animal in vitro fertilization." ... **Jack B. Chaddock**, SM '49, ME '52, ScD '55, associate dean and professor in the Department of Mechanical Engineering and Materials Science at Duke University, was presented with the 1993 F. Paul Andersen Award from the American Society of Heating, Refrigerating, and Air Conditioning Engineers last January. The F.P. Anderson Award is ASHRAE's highest award for scientific achievement in its field.



Suresh Reddy

Suresh B. Reddy, PhD '92, has joined the GE R&D Center as a mechanical engineer in the Solid Mechanics Laboratory. Reddy, a native of India, lives in Schenectady. ... **Gregory F. Zaic**, SM '71, SM '72 (XV), is a general partner in Prince Ventures in Westport Conn. He writes: "Prince Ventures focuses on financing medical start-up companies with venture capital (\$.5-5.0 million). I'd be pleased to discuss suitable venture situations with classmates and their friends." ... From

Dhahran, Saudi Arabia, **A. Kerim Kar**, SM '76, PhD '80, sends word: "I will be coming to MIT to spend my sabbatical year in the Mechanical Engineering Department starting March 1993. My wife will take English language courses at ELS in Boston and my son will have a smell of MIT." ... **Bulent E. Platin**, SM '72, ScD '78, reports: "In September 1992, I was appointed associate dean for academic affairs at the School of Engineering in the Middle East Technical University in Ankara, Turkey. The School of Engineering is roughly 40 percent of the university in terms of student body and staff, ranking 1st in Turkey. Total number of students (undergraduate and graduate) is about 8,000, distributed to 14 departments." ... **William A. Dewey**, SM '74, OCE '75 (XIII), is head of the Business Planning Department at the Long Beach Naval Shipyard in California.



R. Davis Webb

R. Davis Webb, Jr., SM '81, PhD '87, has been named manager of prototype manufacturing at the Timken Co.'s Technology Center in Canton, Ohio. Webb joined the company in 1982 as a process engineer in the Technology Center, where he served in subsequent positions as principal development engineer, development specialist, and product development specialist, his most recent position. ... **Navy Captain Carl N. Strawbridge**, SM '78, SM '78 (XIII), was recently promoted to his present rank while serving with the commander of the Portsmouth Naval Shipyard in Portsmouth, N.H. ... **Navy Lieutenant Mark Stanko**, SM '92, OCE '92 (XIII), recently graduated from the Engineering Duty Officer School. During the course held at Mare Island in Vallejo, Calif., students received training in the plans, programs, policies, and procedures by which the Navy accomplishes the lifecycle of Navy ships and their systems. Studies also include Navy R&D, acquisition, and maintenance. ... **Ferdie B. Stern, Jr.**, SM '40, of Wayland, Mass., died on December 27, 1992. He retired after 42 years with the Magnaflux Corp., where he was involved in research and sales. He lectured and participated in educational programs in the fields of non-destructive testing and experimental stress analysis. Following his retirement, he had been associated with several corporations, as well as the U.S. Army Materials Technology Lab. Stern was a registered professional engineer in Texas and Massachusetts. He was also a member of several professional organizations including ASME, ASM, and the American Society for Non-Destructive Testing. ... The Association of Alumni and Alumnae has been notified that **Donald J. Spooner**, SM '52, of Honeoye Falls, N.Y., died on January 6, 1992. No further information was provided.

III MATERIALS SCIENCE AND ENGINEERING

Joseph R. Lane, ScD '50, writes: "Since retiring, I am able to spend more time making music. The highlight of last year's activity was performing in an orchestra in Carnegie Hall and in concert halls in Moscow and St. Petersburg." ... From River Hills, Wisc., **Michael D. Rehtin**, PhD '70, reports: "[I am] chair of the Intellectual Property Department of the Reinhart, Boerner law firm; our section has grown to six attorneys and five support staff. My son, Michael D. Rehtin, Jr., '89 (XIV), is now an attorney in Grand Rapids, Mich., at Dickinson, Wright, and Van Dusen." ... **Charles Finn**, PhD '71, is an assistant professor in the Materials Division of the Department of Mechanical Engineering at Northeastern University in Boston. ... From Tainan, Taiwan, **Chi-Yuan Albert Tsao**, PhD '90, writes: "I have been appointed by the National

Cheng Kung University in Taiwan, as an associate professor in the Department of Materials Engineering." ... **George Mayer**, PhD '67, sends word: "After several years in Washington, D.C., with the Institute for Defense Analyses, I joined the University of Pittsburgh as research professor and associate director of the Materials Research Center." ... From a Navy press release: "Navy Lieutenant Commander **Daniel J. Peters**, SM '89, NE '89 (XIII), recently arrived off the coast of Somalia aboard the aircraft carrier USS *Kitty Hawk*, homeported in San Diego, in support of the relief effort Operation Restore Hope. Deployed to the Western Pacific and Indian Ocean since early November, the *Kitty Hawk* battle group relieved the USS *Ranger* battle group off Somalia. ... Navy Lieutenant **Zan E. Miller**, SM '92, OCE '92 (XIII), recently graduated from the Engineering Duty Officer Course. During the course, held in Mare Island, Vallejo, Calif., students receive training in the plans, programs, policies, and procedures by which the Navy accomplishes the lifecycle of Navy ships and their systems. Studies also include Navy R&D, acquisition, and maintenance. Miller joined the Navy in 1985.

IV ARCHITECTURE

Earl Kessler, MAR '71, writes: "I am now chief of the Regional Housing and Urban Development Office (RHUDO) for Asia, USAID. My region covers Nepal, Pakistan, India, Sri Lanka, Thailand, Mongolia, and soon Indo-China-Laos, Cambodia, and Vietnam. The RHUDO/Asia office is located in Bangkok, Thailand." ... From Somerville, Mass., **Marc A. Maxwell**, MAR '85, reports: "Last year's accomplishments include successfully completing a third year as a gainfully self-employed consulting architect. During 1992, I co-chaired a national design competition on 'Housing for People with AIDS'; had two projects published—one for design and one for programming methodology, had a paper presented in Paris; completed a master plan for capital improvements to a 500,000 SF condo in Boston, and provided space programming to the City of Boston for the Public Schools and Public Facilities Departments." ... **Robert Breuer**, MCP '62, writes: "As a consultant in transportation planning and engineering since 1991, I am laying out the planning program for New York's Canal System, for the New York State Thruway, its new operator." ... **Thomas P. Melone**, MCP '55, reports: "Since 1989, I have been regional environmental officer in HUD's Boston office." ... **Paul Ries**, MAR '89, sends word: "My wife, Jacque, and I are happy to announce the birth of our 2nd son—Alexander James—on July 19, 1992. Both he and his brother, Nicholas, are happy and healthy, as are their folks. I am still working with **Aran Faegre**, MAR '76, in Portland, Ore. We have been rather busy this past year and I've had the good fortune to work on a few projects that have made all the long hours worthwhile: An emergency communication center; a base camp/observatory for an estuarine reserve; and a community policing/youth activities/retail development. A hearty hello to all of my classmates!" ... **Samuel J. Cullers**, MCP '52, writes: "I am president of Cullers & Associates, environmental planning and development consultants of Sacramento, Calif. I organized and am now president of the Sacramento Chapter of Lambda Alpha International, the honorary land economics society. The chapter, which now numbers approximately 30 members, had its first annual initiation dinner on November 19, 1952." ... From Boston, **Samuel C.M. Wang**, MAR '62, reports: "My mission as chief architect in a predominantly engineering firm is to market internally as well as externally. 1993 is significant for my employer, Parsons Main, Inc., (known formerly as Chas. T. Main, named after Charles T. Main, Class of 1876 (II)) as it celebrates its centennial year. Parsons Main is currently working on an engineering project for the Institute which could be architecturally and urban

1905-1992

Truman S. Gray

Truman S. Gray, SM '29, ScD '30, of Lexington, Mass., died on November 7, 1992. He was professor emeritus of engineering electronics and a pioneer in the field of electronic instrumentation, measurement, and control.

Gray began his teaching career at MIT 65 years ago as a research assistant, and he became a vital force in what is now the Department of Electrical Engineering and Computer Science. He regularly came into his MIT office up to the time of his death.

Gray's doctoral thesis, supervised by the late Vannevar Bush, EGD '16, involved the design and construction of a machine to perform analog numerical integration. Out of this work and from his teaching in this area came a book, *Applied Electronics*, which became an authoritative text for the field of electronics; it was translated into Japanese and Spanish.

After serving as a research assistant and instructor, Gray was appointed an assistant professor in 1935. He was promoted to associate professor in 1942



and professor in 1960. At his retirement in 1971, his graduate-level course, "Electronic Instrumentation and Control," begun in 1934, was the only departmental subject still listed in the catalogue under its original instructor. He taught the premier departmental subject in electronic instrumentation and continued to do so even after his official retirement.

During a leave from MIT in 1947-48, Gray took charge of designing and developing reactor instrumentation at the newly established Brookhaven National Laboratory. He also served as an expert witness in legal cases.

Gray maintained a special interest in music all his life. He played the clarinet for many years with concert bands, including the Concord Band and the Lexington Bicentennial Band. He was a founding member in 1957 of the Tabor Hill Dixieland Jazz Band, playing clarinet with the group for the past 35 years. He was also an accomplished amateur silversmith and glassblower. □

design sensitive." ... **Sally A Sweetland**, MAR '86, and **Jeff Schoellkopf**, MAR '84, write: "Sally has had shows of recent oil paintings in the past year at the Woodstock Gallery of Art in Woodstock, Vt., and Peden Gallery in Raleigh, N.C., and is a featured artist in the Contemporary Women Artists Calendar for 1993. Her home and studio is in Warren, Vt., with her husband, Jeff, and son, Carson, 2 1/2 years old. Jeff is a registered architect and partner in the Edgcomb Design Group of Warren, Vt., with **Jim Edgcomb**, MAR '84. Recent work includes residential and commercial design and planning in Vermont, Maryland, Delaware, Florida, New York, and Wyoming. He teaches periodically at the Yestermorrow Design/Build school in Warren." ... **Harold R. DeMoss, III**, SM '88, reports: "I have recently moved to Houston, Tex., from Orange County, Calif. I'm now performing real estate consulting services to land owners and developers. My wife, Jan, is expecting in February 1993 (as of this writing). We are currently house-hunting and hope to be settled by mid-January." ... Word from **Mary Murtagh**, MAR '73, in Berkeley, Calif.: "I am enjoying real estate development, as head of a nonprofit corporation. We build beautifully designed apartment complexes for low-income families and first-time home buyers. Satisfying work with no dull moments—except in zoning hearings. My three-year-old son keeps life exciting at home! Best wishes to the architects of 1973." ... **Robert S. Allan**, MAR '55, writes from Irving, Tex.: "Robert S. Allan & Associates, Architects, Engineers, and Consultants, are very fortunate to now be in their 25th year of providing commercial and institu-

tional design to the Southwest. Current projects include a 10-story memorial bell tower incorporating a chapel. Letters from classmates are welcome." ... **Sarah Abrams**, SM '85, has been selected as the first winner of the Charles Spaulding Award for significant professional achievement by a graduate of the Center for Real Estate at MIT. The center established the award in 1991 to honor Hank Spaulding, whose energy and vision led to its founding. Abrams was honored for her leadership and creativity in helping to restore the Cambridge YWCA. Prior to the \$1.85 million renovation, the YWCA's ability to carry on its activities in the community was threatened by the severe deterioration of its facilities. The project was completed in June 1991 and included rehab of the residence floors (100 units of single-room-occupancy housing) and the restoration of the offices, function rooms, and public space. Abrams was then the principal of the Trover Co., a Boston real-estate development consulting company. She is now with the United States Trust Co., where she is VP of Real Estate Owned, responsible for management and disposal of the bank's \$50 million portfolio of properties. She is also an adjunct professor of law at the Cornell Law School and teaches a course on the legal aspects of real estate development.

John D. MacBeth, '45, of Vero Beach, Fla., died on November 21, 1992. He was employed by the New Bradford Co., Inc., as treasurer until his retirement in 1982. MacBeth was a WWII navy veteran. He was treasurer of Coombs and MacBeth Ford in Boston; president of Ashley Ford Sales in New Bedford and of the Metropolitan Ford Dealers Association in Boston; a council member to the National Ford Dealers Coun-

cil; past member of the Union Boat Club in Boston, Eastern Yacht Club in Marblehead, and Kittansett Golf Club in Marion; and commodore of the New Bedford Yacht Club in South Dartmouth.

V CHEMISTRY

Allan L. Smith, PhD '65, writes: "I have been primarily a chemical educator during the past several years. I've been thinking and working on the essentials of chemistry which every engineering student should know. I have also done research on the fullerenes." ... From **Wynnewood, Pa.**, **George A. Frank**, PhD '65, reports: "In February 1992, I was named corporate counsel at E.I. du Pont de Nemours and Co." ... **K. Barbara Schowen**, PhD '64, sends word: "Richard L. Schowen, PhD '63, the Solon Summerfield Professor of Chemistry and Biochemistry at the University of Kansas, is now, as of July 1, 1992, also professor of pharmaceutical chemistry. In November he received the Midwest Award of the St. Louis section of the American Chemical Society." ... **Philip E. Rakita**, PhD '70, reports: "I have recently accepted a position as a director of the Akishima Co. (a wholly owned subsidiary of the Elf Atochem Japan, an arm of the French petrochemical company Elf Aquitaine). Based in Tokyo, I will be responsible for technology transfer and corporate development. Akishima Co. is a producer of plastics additives for the polymer and resins industry. During this assignment, my wife, Elizabeth Armour, and I will retain our home in Paris." ... **Carl Pilcher**, PhD '73, sends word from Washington, D.C.: "I am currently chief of the Advanced Studies Branch of the Solar System Exploration Division at NASA." ... **Dale Lichtenberg**, SM '69, has been named quality improvement manager in the Resins Department at American Cyanamid Industries in Wallingford, Conn. Previously he was a research chemist providing technical support at the company.

Faith Louise Van Nice, PhD '89, of Boston, died on January 3, 1993 after a long fight against cancer of the cervix. As part of her doctoral thesis, Van Nice designed and built a device for diagnostic use in magnetic resonance spectroscopy at extremely low temperatures, around 462 degrees below zero Fahrenheit. Van Nice then studied medicine at the joint MIT-Harvard Medical Health Sciences and Technology program. She was to have served a residency in surgery at the Massachusetts General Hospital. Beginning during her undergraduate studies at the University of Oregon in Eugene, Van Nice wrote and published prolifically in scientific journals. She taught classes at Harvard, MIT, Harvard Medical School, and MGH. She received many awards, honors, and fellowships, including the Hertz Fellowship at MIT, under which she studied for her doctorate in physical chemistry. She also became consultant to such organizations as the Bell Laboratories in Murray Hill, N.J., New England Deaconess Hospital, and Children's Hospital. As an undergraduate, Van Nice was a marathon runner and skydiver, but physical injuries forced her into the swimming pool by the time she got to MIT. She swam five or six days a week, and competed in the New England Masters division, four times making her way to the top 10 in women's freestyle. Friends say she endured the disease for 15 months without any complaints and with the same resolve and stoicism she had devoted to her work. "She was a fighter," said **Valerie Copie**, PhD '90, Van Nice's roommate at MIT and a post doctoral fellow at the National Institutes of Health. "She was someone who would never give up," taking an aggressive approach to chemotherapy and radiation and subjecting herself to a highly experimental course of drug treatment in New York. Van Nice married Bruce Hunter 70 days before her death.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Adolfo Guzman, SM '67, PhD '69, writes: "I am now head of Software Pro International, a 1991 startup. The firm specializes in leading-technology software applications, unique solutions, and soft-

HUGH HERR

Spring-Loaded Entrepreneur

A graduate student in mechanical engineering designing new lower leg prostheses is not particularly startling at MIT. But few graduate students—here or anywhere else—have arrived at their research topics via routes as dramatic as Hugh Herr's.

Introduced to rock climbing at the age of eight by his older brothers, Herr was acknowledged as one of the half-dozen best climbers in the United States by the time he was 18. In January 1982, he and his climbing partner became disoriented in a New Hampshire storm and spent three nights in the woods with inadequate gear. That either survived is a miracle, but both were seriously frostbitten. Doctors had to amputate both of Herr's legs below the knee; his partner lost one leg and some fingers. Most tragic of all, one member of the rescue party, Albert Dow, did *not* survive—he was killed in an avalanche on the second day of the search.

Herr was soon fitted with leg prostheses, and he immediately began redesigning them. He made the socket more comfortable and the attachment more secure, adding padding at pressure points and contriving special lycra pants to hold the prosthesis in place. He was determined to climb again, which called for further adaptations: he molded tapered rubber feet of various sizes for different types of cracks and machined variable-length shanks so he could change his leg length to suit the spacing of the ledges on the rock. The results were not only good enough to allow him to regain his prior climbing level—and ultimately to earn a U.S. patent—but actually led other climbers to tease him about having an unfair competitive advantage.

A book about Herr's recovery from tragedy, *Second Ascent* by Alison Osius, describes him as a youth who was not particularly interested in academics. But a few years after the accident, he started having mixed feelings about climbing, and he realized that he needed a more



Hugh Herr is not the first MIT student to practice rock climbing on the wall of the Chapel, but he is the only one to do it on prostheses he designed himself.

sustainable focus for his life. He tackled college with the same energy and single-mindedness that he applied to overhanging rock faces, sailing through the undergraduate physics program at Millersville University in Pennsylvania with only one grade lower than an "A": a "B" in a film class.

On the side, he broadened his solitary research on prostheses, working with composites, epoxies, acrylics, and other exotic materials to lighten and stiffen the devices. Comfort is a serious issue, as the nerve endings, ligaments, and bones in a limb's stump retain little of their natural padding. What's more, the stump changes shape throughout the day, in response to temperature and use, making attachment and fit difficult. Herr ultimately envisions a socket with bladders of fluid sited at tender points and microprocessor-controlled hydraulics capable of adapting the pressure in each bladder to the changing size and use of the limb.

Herr was admitted to several graduate schools, and he remembers being actively recruited by MIT Professors Robert Mann, '50, and Woodie Flowers, PhD '73, known for their passionate

interest in engineering design in general and prosthesis design in particular. Herr was surprised and won over.

Enrolled at MIT since fall 1991, Herr is working on a thesis that explores new approaches to the design of human-powered devices. In an inquiry of remarkable—and stubbornly held-to—breadth, he is looking at a variety of tools for motion, ranging from below-knee prosthetic limbs to racing shells, from cross-country ski equipment to handsaws. He explains, for example, that a person sawing a plank of wood at a high enough frequency must constantly decelerate the motion and change the direction of the thrust. As far as Herr is concerned, the alternating brake and push, brake and push wastes energy. For his thesis, he is exploring whether a passive energy storage device (spring) could reduce the metabolic cost associated with using each piece of equipment.

Other grad students in his lab describe Herr's designs as "crazily creative—they either succeed or fail spectacularly." He tries things that saner, more stolid designers wouldn't even consider. For example, he won a patent for a running suit with embedded springs, designed to minimize the energy a runner loses through normal arm motion, but at least one of his peers is skeptical it will work. Older colleagues say that he mixes hardcore analysis with intuitive, seat-of-the-pants innovation; he grumbles when the two don't jibe, which violates his view of the world as tractable if you work hard enough. Herr admits that this risk-taking creativity—what he calls "believing without seeing"—is for him the hardest part of being a designer.

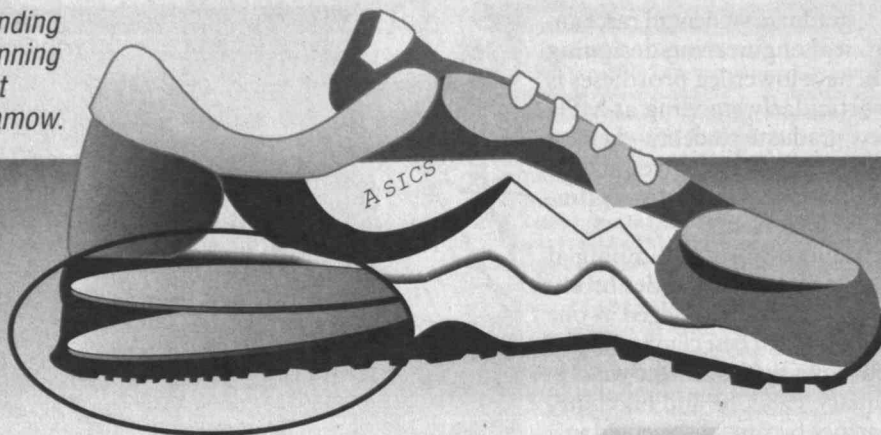
An Extraordinary Partnership

While he is a long way from a finished thesis, there are other indicators of Herr's productivity. With a collaborator, Professor Igor Gamow of the University of Colorado, Herr has extended

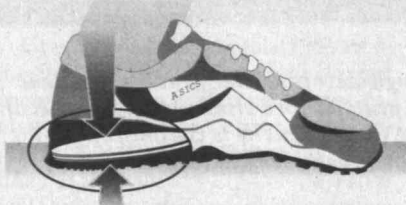
MOVE OVER, REEBOK

ASICS running shoe company is funding research and development on a running shoe designed by graduate student Hugh Herr and his partner, Igor Gamow.

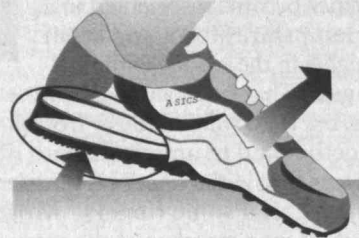
The increased bounce comes from strong, light, carbon-fiber springs that return about 90 percent of the energy stored.



In a nutshell:
1. The runner's heel strikes the ground, compressing the carbon-fiber heel spring.



2. As the foot rolls forward, energy is released from the heel spring, pushing the heel upward and compressing a sole spring that extends from heel to toe.



3. As the foot leaves the ground, the sole spring releases its energy, propelling the runner forward.

his fondness for springs to running shoes. Gamow is a colorful character with a reputation for human performance engineering and a famous name. (His father, George Gamow, came up with the Bing Bang theory of the origin of the universe.) Igor is famous in climbing and mountaineering circles as a designer of prostheses and climbing gear—notably the Gamow bag, which can save the life of a climber by simulating the atmospheric conditions of lower altitude.

An enthusiastic and frequent visitor to the mountains of Colorado, Herr walked into Gamow's office one day with his drawings of a running shoe—also patented—with graphite springs embedded in the sole (see accompanying drawing). Their partnership was born on the spot.

Gamow has the stature and entrepreneurial experience that Herr lacks,

and evidently he also has the right personality to collaborate with his fiercely independent younger colleague. Reports on the shoe concept in publications like *USA Today* almost inevitably assume Gamow is the driving force behind the innovative design, Herr the junior partner. Herr refuses to let it bother him. "The reporter is saying that, not Gamow," he states. "It's a great partnership," he adds, with unmistakable intensity.

They are now at the stage where they need a large infusion of capital—not surprising when custom graphite and molding for a pair of prototype shoes can add up to more than \$1,500. The ASICS running shoe company has recently agreed to fund further research and development, which presents Herr with a painful choice. He can take a leave of absence from MIT and devote all of his time to developing the concept into a

product, do both product-development and his master's thesis simultaneously—at some cost to the quality of both—or farm out the running shoe to others. Herr will probably choose the leave-of-absence route, but he worries that the actual design work might be so much fun that he won't want to come back and finish the degree.

Engineering research and entrepreneurship are a long way from the activity for which Herr was once famous. He finds it very frustrating when people persist in relating to him only as "that rock climber who lost his feet on Mt. Washington." Even more painful is the fact that some members of the climbing community still blame him for the death of Albert Dow. (Herr was the more experienced of the two climbers the day he was lost; he made the decision to continue for the

summit that ultimately had tragic consequences.)

Herr is clear that the accident changed his character as much as it changed his anatomy. *Second Ascent* quotes him in conversation with friends: "If it weren't for Albert Dow, I'd do it all over again. . . . If the accident had never happened, I would still be a mindless jock." In fact, he rarely climbs now, except to make a case for the athletic potential of people with physical handicaps or to teach a friend to climb. Normally reticent and preoccupied with technical puzzles, he will put all that aside for something like an invitation to speak at Vermont Disability Awareness Day. Although he squirms when asked, uncomfortable with an answer that can sound self-important, his overriding motivation seems to be the desire to make a contribution.

He admits he would also like to make lots of money, but that is "so I can be free to spend all my time thinking." He is constantly wrestling with multiple problems in parallel and says solutions to differential equations sometimes come to him while he is focusing on something else. He dreams of constructing a personalized "think tank," high in the mountains over Boulder. He sees a circular room with high ceilings and a domed skylight that doubles as an observatory, reached by a mechanical lift from a swivelling, central chair in a sunken, book-lined contemplation pit. Chalkboards encircle the room, so he could start writing and keep moving without interruption as ideas evolved. In such a room, he wants to mature into what author Chelsea Quinn Yarbro calls an "old soul": someone whose analytical and spiritual processes are complete, intertwined, and seamless. □

—ELIZABETH BRADLEY, '83, PhD '92, is an assistant professor of computer science and electrical engineering at the University of Colorado, Boulder. Like Herr, Bradley is an engineer with a background as a competitive athlete—she was a member of the U.S. women's rowing team at the Seoul Olympics.

ware tools to increase programmers' productivity. Being a native of Oaxaca, Mexico, I believe there is a huge opportunity to apply the technological skills acquired in MIT and in the U.S. to my native country. I do this from the not-too-distant (from Mexico, that is) Austin, Texas. Initial activities in Mexico are in the educational market and in design tools." . . . Stanley P. Lapin, SM '47, reports: "I retired as president of the St. Thomas and San Juan Telephone Co.—the second largest long-distance carrier in the U.S. Virgin Islands." . . . Arlyn W. Boekelheide, SM '52, sends word that he was sorry to have missed his 40th reunion. He hopes to make it to the 45th or 50th. . . . Lotfi A. Zadeh, SM '46, writes: "I became professor emeritus in 1991 and am currently serving as the director of BISC (Berkeley Initiative in Soft Computing). I was awarded the IEEE Richard W. Hamming Medal in 1992 and was elected as a foreign member of the Russian Academy of Sciences (Section of Computers and Cybernetics)." . . . Frederick J. Leonberger, SM '71, EE '72, PhD '75, is general manager of United Technologies Photonics, Inc., a new subsidiary formed by UTC in January 1992. . . . Jeff Abramowitz, SM '85, reports: "I am the radio systems project manager at D.A.C., a communications technology start-up in San Carlos, Calif." . . . John Max Cochran, Jr., SM '64, writes: "In August 1992, I was promoted to VP of Texfi Industries, Inc., parent company of Highland Yarn Mills, Inc. I was president of Highland from February 1989 to August 1992, when it merged into Texfi. I'm still living in High Point, N.C., and sailing and playing golf when time permits." . . . From San Jose, Calif., John L. Bennett, SM '61, sends news: "I recently retired after 30 years at IBM Research, Computer Science, in San Jose. I am now an independent consultant specializing in usability engineering for effective human-computer interaction and design-team facilitation. I continue as a member of the advisory board for the Association of Computing Machinery's Special Interest Group in Computer Human Interaction (SIGCHI)." . . . Maya Paczuski, '86, SM '86, PhD '91, is among the first 12 Distinguished Postdoctoral Research Program award winners announced recently by the U.S. Department of Energy's Office of Science and Education. Each award carries a stipend of \$52,800 per year in support of research related to the DOE mission. Brookhaven National Laboratory will host Paczuski, and her research will focus on the critical properties and surface ordering effects of holmium. In March 1992, Paczuski went to France through the Les Houches Winter School Travel Award, and in June 1991, she received a NSF Travel Grant for NATO Summer School in St. Andrews, Scotland. . . . Arthur B. Baggeroer, SM '65, EE '65, ScD '68, the Ford Professor of Electrical and Ocean Engineering, has received the Ocean Engineering Society's 1992 Distinguished Technical Achievement Award. Baggeroer was cited for research that has focused on the application of advanced signal processing methods to underwater acoustics and geophysics: "He has been the chief scientist at six ice stations in the high Arctic, where large aperture arrays for acquiring acoustical and geophysical data have been deployed. These data have been used for long-range propagation, reverberation, ambient noise and tectonic measurements in the Arctic."

The Association of Alumni and Alumnae has been notified that Enar R. Eskilsson, SM '34, of Uppsala, Sweden, died on July 7, 1990. No further information was provided.

VI-A INTERNSHIP PROGRAM

The recruiting season for the new VI-A Class is well underway: 168 students attended the annual orientation lecture in February.

Companies providing new openings for the anticipated expansion of the incoming class this year will be Bull HN Information Systems, Inc., Bolt, Beranek & Newman, Inc., Lotus Development Corp., Xerox Advanced Office Document Services Division, and Hughes Networks Systems.

The names of those honored by being named Fellows of the IEEE have just been released. Two are

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VI-A grads: **Thomas M. Jahns**, '73, SM '74, PhD '78,
and Professor **Markus Zahn**, '67, SM '68, EE '69,
ScD '70.

The Center for Electromagnetics Research at
Northeastern University recently named three techni-
cal associate directors. One is **Carey M. Rappaport**,
'80 (XVIII), '82, SM '82, EE '82, PhD '87, a member of
the Department of Electrical and Computer Engineer-
ing faculty. He joined the center in 1987.

In the February / March 1993 column I mentioned
correspondence from **Alexander Kusko**, SM '44,
ScD '51, relating to his having taught the first two
VI-A students to co-op with the American Electric
Power Co. Alex now writes to tell me that the third
VI-A student, whom I didn't mention, was **William
A. Black**, '49, SM '51, SM '62 (XV), retired president
of the Indiana & Michigan Electric Co. (a sub-
sidiary of AEP), in Fort Wayne, Ind.

An interesting article in the January 1993 issue of
Yankee magazine highlights Percy Spencer, of
Raytheon, inventor of the microwave oven. The
late Professor **Truman S. Gray**, '29, ScD '30, used to
tell me about working with Spencer when the latter
was developing the manufacture of early vacuum
tubes in a Raytheon laboratory located on Carlton
Street in Cambridge (in what is now the Medical
Department parking lot). This led to a vacuum tube
teaching lab, set up by Gray at MIT, complete with
glassblowing and vacuum facilities.

Now to the notes on VI-A alumni who've been in
touch: **Steven L. Bates**, '74, SM '76, EE '76, called
one afternoon to say hello and bring me up to date.
... **Thomas H. Crystal**, '59, SM '60, ScD '66,
dropped by for a visit while at MIT for a DARPA-
sponsored Spoken Language Workshop. While he
was in Cambridge, he also visited with son
Michael R. Crystal, '86, SM '87, who is with BB&N
in Kendall Square. ... **Donald H. Gottfried** left a
message that he's with Teradyne in Boston. ... A
Boston Globe article tells of the success of a firm in
Needham, Mass., named Brooktrout Technology,
which is in the forefront of fax technology today.
Among the founders were VI-A'ers **David W.
Duehren**, '80, SM '81, and **Patrick T. Hynes**, '81
(VP). And last, but not least, our VI-A Christmas
greetings received in '92, came from **John F.
Cooper**, '74, SM '76, **Edward Giaimo**, '74, SM '75,
Richard S. Grinnell, **David L. Lyon**, '69, SM '70,
PhD '72, **Pratima B. Rao**, **Jay Van Dwingelen**, '74,
and **John A. van Raalte, Jr.**, '59, SM '60, EE '62, PhD
'64 (from France where he now resides).—John
Tucker, director emeritus, VI-A Internship Pro-
gram, MIT, Room 38-473, Cambridge, MA 02139.

VII BIOLOGY

Michele Piccone, '80, recently joined the faculty at
Scheie Eye Institute as an assistant professor of oph-
thalmology. Scheie Eye Institute is the Department of
Ophthalmology for the University of Pennsylvania
School of Medicine and Presbyterian Medical Center
of Philadelphia. Piccone's special interests are in
cataract and anterior segment surgery. She directs the
medical-student teaching program in ophthalmology
at UPenn, and is interested in the epidemiology and
neurobiology of myopia.

The Association of Alumni and Alumnae has
been notified that **Joseph W. Cogan**, '32, died in
1976. No further information was provided.

VIII PHYSICS

John B. Newman, '49, writes: "I retired in '92 from
Towson State University, following 25 years of
teaching physics and doing research (two photon
phase conjugation and m wave ionization of Ryd-
berg atoms). Previously spent 16 years in research
(infrared and mm wave radiometry mm wave
masers) at Johns Hopkins and two years teaching
physics and math at Talladega College." ...
Leonard Muldawer, PhD '48, professor of physics

at Temple University, reports: "I attended the
memorial session for Professor **Bertram E. Warren**,
'24, SM '25, ScD '29, at the American Crystallo-
graphic Association meeting in Pittsburgh last
August. It was attended by about 25 'old boys';
there was much laughter and we all learned how
profound was BEW's research and influence." ...
News from **Peter B. Ulrich**, PhD '66: "I'm now in
the Astrophysics Division at NASA Headquarters
managing the Advanced X-ray Astrophysics Fac-
ility (AXAF) and the Space Infrared Telescope Fac-
ility (SIRTF). The remaining two 'Great Observa-
tories' are to be launched later in this decade." ...



Nathaniel Hopkins

**Nathaniel (Nat) Hop-
kins**, SM '71, has been
named director of the
U.S. Department of
Agriculture Graduate
School Center for
Applied Technology in
Washington, D.C. The
new center will consol-
idate the graduate
school's daytime com-
puter science and
information resources
management courses
under one program
area. The center's mis-
sion is both to continue
existing programs and

to promote new ones in applied technology. Hop-
kins has been with the USDA Graduate School
since 1984, most recently as program director for
the computer sciences curriculum with the school's
career planning and development programs.

Paul H. Stelson, PhD '50, of Oak Ridge, Tenn.,
died on July 19, 1992. A nuclear physicist, Stelson
began his employment with Union Carbide
Nuclear Division on February 21, 1953, in th
Physics Division of Oak Ridge National Labora-
tory. He became director of the ORNL High Volt-
age Laboratory in 1963 and associate director of
the Physics Division in 1971. From 1973 to 1983, he
served as director of the division. As a Martin
Marietta Energy Systems senior research staff
member, Stelson was a full-time research physicist
for the past nine years. He was the 1986 recipient
of the Jesse W. Beams Award given by the South-
eastern Section of the American Physical Society.
The award is the highest honor for "distinguished
research in physics" given by the society and is
named for the late University of Virginia physicist
and Oak Ridge consultant best known for his work
on gravitation and cosmology and as a pioneer
developer of the gas centrifuge. Stelson was the
third Oak Ridger to win the award. His new
heavy-ion fusion theory was published in *ORNL*
'90, which examines his "dark-horse theory," what
he called the "football theory that could change the
accepted view of what causes higher-than-pred-
icted rates of fusion among nuclei of heavy ions
when one is hurled at another." A Fellow of the
APS, Stelson wrote more than 200 publications in
the areas of nuclear reactions and scattering,
nuclear spectroscopy, Coucomb excitation, and
neutron physics. He also served as the editor of the
physics journal *Physical Review*. In addition, he had
served as an adjunct faculty member at the Univer-
sity of Tennessee since 1968. ... The Association of
Alumni and Alumnae has been notified that **Dave
A. Campbell**, SM '75, of Irvine, Calif., died on Jan-
uary 2, 1992. No further information was pro-
vided.

X CHEMICAL ENGINEERING

From Oakland, Calif., **Joseph E. Leitgeb**, SM '57,
writes: "After 33 years with the Chevron Corp., I
have retired effective September 1, 1992. I am
thoroughly enjoying retirement, playing lots of
golf and making plans to retire in Durham, N.C.,
in 1993. We will be living in the beautiful golf
course community of Treyburn." ... **Howard**

1914-1992

J. Harvey Evans

Ocean Engineering Professor Emeritus J. Harvey Evans, of Brunswick, Maine, died on November 23, 1992; he was 78. Evans was a specialist in ship structure—particularly the structure of vehicles designed to operate at great depths—and computer-aided design of marine vessels. He is credited with being the first to propose a “gross-panel” model for hull-girder analysis, instead of the traditional model that considered a ship’s structure section by section. He also was an early advocate of reviewing hull girder stiffness criteria and for the collection of fabrication data from which tolerance standards might be derived on a statistical basis.

More recently Evans had been involved with the design and development of a 925-foot, post-tensioned, reinforced-concrete ship for transporting liquefied natural gas. The ship has not been built.

Evans once told an interviewer that a naval architect’s primary concern is the seaworthiness of a ship, but he said that



the term “naval architect” was something of a misnomer. “It involves much more than merely “naval” ships and is really engineering rather than architecture,” he explained. “It involves math and the basic sciences and is primarily concerned with the function of the vessel as opposed to aesthetic considerations.”

Evans joined the MIT faculty in 1947 as an assistant professor, after 10 years with the Ship Building Division of the Bethlehem Steel Co. in Quincy, Mass. He became associate professor in 1952, and full professor in 1961. He continued to work in his profession after retiring in 1978. He was general chair of the International Ship Structure Congress in 1976, and served as VP of the Society of Naval Architects and Marine Engineers from 1978-80. Evans was author and editor of several books including *Ocean Engineering Structures* (MIT Press, 1969), of which he was senior author, and *Ship Structural Design Concepts* (Cornell Maritime Press, 1975) □

Klee, ScD '72, sends word from Chicago: “I was recently appointed director of regulatory affairs at Amoco Corp., responsible for managing our response to federal environmental, health, and safety issues. Prior to this I directed a first-of-its-kind study for Amoco and the U.S. EPA. We looked at environmental management opportunities at Amoco’s Yorktown, Va., refinery. This was the first cooperative, comprehensive evaluation of all releases to air, water, and land at a single site. The evaluation provided the basis for formulating and ranking several site-specific management strategies to reduce environmental and health impacts. This two-year-plus effort involved over 200 people from 30 different organizations. A great challenge and education for all who participated.” ... **Chris Schwiier, ScD '84**, reports: “I have begun a three-to-five-year assignment as plastics technology manager with Monsanto Europe, outside of Brussels.” ... From Buenos Aires, Argentina, **Jorge Pefauere, SM '76**, writes: “During 1992, I founded Tecnosolution offices in Brazil and Argentina and became president of both organizations. Tecnosolution’s mission is to provide chemical engineering technology and technical support for the process industries.” ... **Bingham H. Van Dyke, Jr., ScD '72**, reports: “I recently accepted a position of senior instrument/automation engineer with Smith Kline Beecham Clinical Laboratories in King of Prussia, Pa.” ... **Bernard Chertow, ScD '48**, sends an update: “Doris and I had a real adventure going to Antarctica in January 1992. And we will visit Vietnam and Angkor Wat in January 1993. Space is next!” ... From Augusta, Mo.,

Robert L. Slifer, SM '50, writes: “I have been president and winemaker of Montelle Winery for the past 10 years. Missouri is making world-class wines and our wines regularly win awards in international competitions. We are located near the St. Louis metropolitan area and cordially invite anyone to visit our winery and tasting room, which is open 361 days of the year.”

William F. Lewis, '36, of Oceanside, Ga., died on December 27, 1992. He held executive positions at Lewis Tar Products and Fox and Lewis Plumbing and was executive director of the Rockford Housing Authority in Rockford, Ill. He was an executive engineer with the Department of Housing and Urban Development for nine years.

... **Orrington E. Dwyer, SM '36**, of Brunswick, Maine, died on December 1, 1992. Dwyer was a longtime research engineer at Brookhaven National Laboratory. He also was head of the Chemical Engineering Department at the University of Rochester, for several years. During WWII he was on leave from Rochester to work on the Manhattan Project at Oak Ridge, Tenn. In 1974 he was a Fulbright Exchange Fellow lecturing at various Russian science centers. In 1975, he was the recipient of the Distinguished Alumnus Award in Engineering from Northeastern University. ... The Association of Alumni and Alumnae has been notified of the following deaths: **Howard Grekel, SM '47**, of Houston, Tex., on November 26, 1992, and **Henry C. Meiners, ScD '42**, of Palos Verdes Estates, Calif., on December 23, 1992. No further information was provided. **VK please insert this column X-A after course X in Batch II, sorry!**

X-A PRACTICE SCHOOL

Here’s a prescription for the February grey-cold-snowy-days blues in New England: write something for the *Review*—it will be for the May/June issue. So how far away can the long-warm-sunny days of spring really be?

Having successfully defended their PhD theses last fall as the last hurdle to their doctorates, eight Practice School alumni/ae have departed from MIT, and at least seven of them are now busy at their first professional jobs:

Aparna V. Bhawe, SM '89, is now at 3M’s Dry Silver Technology Center in St. Paul, Minn., where she joins her husband **Subodh Kulkarni, SM '86**, PhD '90; they live Woodbury, Minn. ... **Henry R. Holgate, SM '89**, now lives in Fairfax, Va., and works at Mitre Corp., McLean, Va. ... **Joanne Liu, SM '88**, is at Cabot Corp., Billerica, Mass., but still lives in Cambridge. ... As announced previously, **Thomas Meadowcroft, SM '90**, is director of the Practice School’s West Point (Pa.) Station at Merck and Co.’s pharmaceutical plant. ... Also in Pennsylvania: **Joy L. Mendoza, SM '89**, in monomers research at Rohm and Haas, Spring House, Pa. and living in nearby Lansdale. ... **Ganish Venkataraman, SM '89**, is at Perceptive Biosystems in Cambridge. ... and **Xinjin Zhao, SM '90**, is living in Columbia, Md., working at the Davison Chemical Division of W.R. Grace and Co. We lack information on the eighth of last fall’s PhDs: **Gordon C. Smith, SM '90**, whose post office address is in Waterford, Mich.

Ashley Shih, '91, SM '92, is in process design engineering at Amoco Oil Co., Chicago, “doing the same thing I did in Practice School and getting paid for it,” she told Carol Phillips in X-A headquarters at MIT. ... Also in Chicago: Shih’s classmate **Deborah Ellingson Johnston, '91, SM '92**, working as a consultant at Vitamins, Inc.; she was married to Blaine Johnston on December 19, 1992, and visited X-A headquarters in Cambridge shortly thereafter. For a home away from home, all Practice School alumni/ae are always welcome at 66-309, where Carol will provide coffee, a willing ear, and all the latest gossip on X-A.

Eduardo F. Herreras, '43, is one of the few who took bachelor’s degrees in the Practice School; to celebrate his impending (gradual) retirement, Herreras sends us a biography, the highlights of which are: worked with Shell in the U.S. until 1948, then returned to his native Guatemala to be: general manager of Molino Helvetia, S.A. (wheat milling), general manager of Agrícola Chitalon, S.A. (coffee and rubber), co-founder of Industrias Tropicales, S.A., and Industrias de Latex, S.A. (rubber processing), co-founder and president of Industria Harinera Guatemalteca, S.A. (flour milling), co-founder and president of Industria de Maiz, S.A. (tortilla flour), co-founder and director of Banco Granai & Townson, S.A., co-founder and director of Lineas Maritimas de Guatemala, S.A. (shipping), co-founder and president of Instrumentos Musicales, S.A. (RCA distributor), co-founder and president of Empacadora de Cereales, S.A. (grain import and distribution), and director of Seguros Granai & Townson, S.A. (insurance). Also active (when did he find time?) in sports (squash, golf, and rowing on Lake Atitlán) and religious and cultural affairs. ... **Albert Ackoff, SM '39**, says he, too, is “slowing down” but still enjoys opera in New York, Washington, Florida, Toronto, Ottawa, and Montreal—“also dance groups, theater, and small musical events, both classical and Dixieland.”

From **David Brown, SM '40**, Key Largo, Fla. (10 miles from Homestead): “Still busy cleaning up after Hurricane Andrew.” ... **Robert C. Howard, SM '55**, executive vice-president of Thermo Electron Corp., Waltham, is now a director of Baybanks’ West Suburban Division; he’s also chair of the board of Thermo Trex (San Diego) and Energy Systems Corp. (Salt Lake City).

Be a chemical engineer and see the world department. When Zyna, the firm for which he worked, merged with Ciba-Geigy’s self-medication organization, **J. Louis Roux-Buisson, SM '78**, became Ciba-Geigy’s acquisitions manager for self-medication

drugs in Europe. Living in France, he says he misses the Institute and the U.S. "and all their challenges." ... No regrets from **William K. Fraizer**, SM '80, who reports from Port Moresby, Papua New Guinea, where he is Chevron's manager of environmental and safety programs: "In June we successfully began production and export of oil from our fields in the highlands. We also assisted in the successful effort to have the Lake Kutubu area declared a protected area. Presented a paper on our programs at the PNG Society of Professional Engineers. Completed my scuba certification and am enjoying diving in the waters around Port Moresby and Rabaul." ... In Bombay, **Vikram Kothari**, SM '82 (X), SM '84 (XV), CHE '84 (X-A), stays busy "exporting garments (Oxford button-down shirts), selling computer systems to the chemical industry, and windsurfing." Vikram was married in January 1992, and he and his wife Nehal "would be happy to have MIT CHE's visit us," he writes.

When he retired in 1984, **David Swanberg**, SM '40, turned his Practice School experience from engineering to history—especially the industrial history of the northeast from 1790 to World War I. "I have focused especially on the rivers, from the Brandywine in Delaware where Du Pont had its genesis up through the rivers of Maine," he wrote. "For one, I am interested in the pioneering work before 1918 on chlor-alkali at Rumford Falls."

To celebrate the 75th anniversary of X-A two years ago, **Henry J. Sandler**, '47, SM '48, surveyed the 9 members of his IA-47 Practice School group on their post-MIT careers. All 9 responded: all were married, one separation and one divorce. A total of 24 children: 12 boys, 12 girls. Classmates worked in 24 different companies/institutions in 24 states and 9 foreign countries; titles before retirement included technical manager, corporate technical director, senior process engineer, professor, general manager, operations supervisor, management consultant.

Donald C. Harrison, SM '31, of Roxbury, Conn., died in New Milford, Conn., last December 2 at 85. He had joined the patent department of Union Carbide upon leaving MIT and for the last 25 of his 37 years there was head of the department. Upon retiring he took an active role in Roxbury town government and—as an enthusiastic amateur painter—in the Washington (Conn.) Art Association, of which he was president from 1976 to 1980. ... The Association of Alumni and Alumnae has learned that **Wei Pang Han**, SM '41, who was retired from Mobil's Chinese chemical operations, died in Mississauga, Ontario, on July 30, 1992; further details were not available.—John Mattill, *Technology Review*, MIT, Room W59-200, Cambridge, MA 02139.

XI URBAN STUDIES AND PLANNING

Ross A. Cantwell, SM '90, writes from Halifax, Nova Scotia: "My wife, Margot, and I are pleased to announce the birth of our daughter, Emily, on July 28, 1992. We have recently purchased a 'cottage' with a commanding view of the harbour and have opened an environmental consulting firm specializing in engineering, planning, and landscape ecology." ... **Charles J. Touhill, Jr.**, SM '61, president of Baker-TSA, Inc., in Corapolis, Pa., has been selected by the American Academy of Environmental Engineers to be the Kappe Lecturer for 1992. ... **Irene D. Jenkins**, SM '89, sends word: "I moved to Jericho, Vt., on August 1 to take the position of director of housing development at the Vermont Housing Finance Agency in Burlington. Call if you are passing through or coming to northern Vermont to ski." ... **Arthur W. Busch**, SM '52, sends us an update on his activities since graduation: "Rice University professor 1955-75, EPA Regional Administrator 1972-75, VP Southwest Residential Institute 1975-76, private consultant 1976-90, and retired in Wimberley, Tex., in 1990." ... **Vilma Barr**, '73, writes: "I have written a new book, *The Best of Neon*, published by Rockport/Allworth Press. The 256-page, all-color book covers all aspects of current neon design, including architectural, interiors, signs, and fine art. I am working on

several other works, and am a marketing and promotion consultant to design and construction firms from my New York City base." ... **J. Alberto Harth Deneke**, MCP '66, PhD '78, reports: "I am currently division chief for infrastructure, Occidental and Central Africa, at the World Bank in Washington, D.C." ... **Adriana Stadecker**, MCP '73, PhD '76, has been appointed VP for executive operations at Digital Equipment Corp. in Maynard, Mass. Stadecker has been managing the company's redesign and restructuring efforts and working with the senior management team to lead the implementation of the new company direction. In her new position, she also will be responsible for overseeing the process of developing strategic and operational plans for achieving the company's short- and long-term financial and business objectives. Before joining Digital in 1981, Stadecker held a variety of university and government agency research, development, and planning positions in the U.S., and prior to that was a practicing architect in Argentina.

XIII OCEAN ENGINEERING

Wayne J. Rogalski, SM '79, OCE '79, writes: "Since March 1987, I've been district engineer and assistant general manager for the Bangor Water District in Bangor, Maine. I also own and manage a 170-acre tree farm in Bradford, Maine." ... **John T. Drewry**, SM '66, reports: "I am VP for operations of my own company, Advanced Marine Enterprises, in Arlington, Va. The company employs 200 people in the field with several offices." ... **Peter Tarpgaard**, SM '68 (II), NE '68, PhD '70, sends word from Eliot, Maine: "I have been appointed professor of national security studies at the U.S. Naval War College in Newport, R.I." ... **William A. Dewey**, SM '74 (II), OCE '75, is head of the Business Planning Department at the Long Beach Naval Shipyard in California. ... From a Navy press release: "Lieutenant Commander **Daniel J. Peters**, SM '89 (III), NE '89, recently arrived off the coast of Somalia aboard the aircraft carrier USS *Kitty Hawk*, homeported in San Diego in support of the relief effort, Operation Restore Hope. Deployed to the Western Pacific and Indian Ocean since early November, the *Kitty Hawk* battle group relieved the USS *Ranger* battle group off Somalia. This is the *Kitty Hawk*'s first deployment since completing a four-year overhaul in December 1991, extending its service life by 15 years." ... Navy Captain **Carl N. Strawbridge**, SM '78, SM '78 (II), was recently promoted to his present rank while serving with the commander of the Portsmouth Naval Shipyard in Portsmouth, N.H. ... Navy Lieutenant **Mark Stanko**, SM '92 (II), OCE '92, recently graduated from the Engineering Duty Officer School. During the course held at Mare Island in Vallejo, Calif., students received training in the plans, programs, policies, and procedures by which the Navy accomplishes the life-cycle of Navy ships and their systems. Studies also include Navy R&D, acquisition, and maintenance. ... **Arthur B. Baggeroer**, SM '65 (VI), EE '65 (VI), ScD '68 (VI), the Ford Professor of Electrical and Ocean Engineering, has received the Ocean Engineering Society's 1992 Distinguished Technical Achievement Award. Baggeroer was cited for research that has focused on the application of advanced signal processing methods to underwater acoustics and geophysics: "He has been the chief scientist at six ice stations in the high Arctic, where large aperture arrays for acquiring acoustical and geophysical data have been deployed. These data have been used for long-range propagation, reverberation, ambient noise, and tectonic measurements in the Arctic."

Captain **Thomas Hennessey**, SM '46, USN (ret.), of Dedham, Mass., died on November 21, 1992. Hennessey was planning officer and controller at the Boston Naval Shipyard from 1946-49 and from 1959-63. He served during WWII aboard the USS *New Mexico* in the Pacific until 1944. He was assigned to the USS *Leyte* during the Korean

War and was involved in ship design and maintenance in Washington, Annapolis, and Norfolk. When he retired from the Navy in 1964, Hennessey, a registered engineer in Massachusetts, worked in management at The Foxboro Co. for 18 years. He was an active member of the Naval Academy Alumni Association and a member of the American Society of Naval Engineers. ... Commander **David M. Kaetzel**, SM '59, NE '59, USCG (ret.), of Vero Beach, Fla., died on November 12, 1992. After his retirement from the USCG, Kaetzel moved his family to Sumatra, Indonesia, where he designed and maintained an oil tanker shipyard and taught the Indonesians to operate and maintain their tanker fleet. After that assignment he returned to the United States, living in Berkeley Springs, W.V., Ft. Lauderdale, Fla., and finally Vero Beach.

XIV ECONOMICS

William J. Stull, PhD '72, writes: "I was reelected chair of the Economics Department at Temple University in Philadelphia, Pa. I am the coauthor of two books published by the University of Pennsylvania Press: *Post-Industrial Philadelphia* (1990), and



David Lipsky

Work, Wages, and Poverty (1991). ... **David B. Lipsky**, PhD '67, has been reappointed to his second five-year term as dean of the School of Industrial and Labor Relations at Cornell University. In his second term, Lipsky will oversee a new plan designed to ease freshmen into academic life by their meeting with faculty in small groups. Among other tasks high on his list of priorities will be evaluating and rewarding faculty for their teaching skills and building on the school's centers and institutes.

XV MANAGEMENT

Mark A. Trozzi, SM '67, writes: "I have accepted the position of VP and controller of Brooks Fashion Stores, Inc. Brooks Fashions, which is headquartered in New York City, operates 540 stores in major malls throughout the United States." ... **Gary Schweikhardt**, SM '73, is CEO at Optimedx, a Seattle start-up involved in imaging brain function and intraoperative tumors. ... **Yukio Ito**, SM '78, reports: "My family and I moved to Hong Kong in August 1992, due to my new job assignment as one of the deputy general managers in Sakura Bank's Hong Kong office. Business in Hong Kong and South China is currently active in contrast to the sluggish economy of Japan. So far, substantial emphasis has been put on dining with people of Japan-origin institutional clients! I would be most happy to see old friends who happen to have a chance of dropping by for business or whatever." ... **Nariman M. DeBoo**, SM '69, is senior director of financial management at American Express Bank in New York City. ... **Alexis Falquier**, SM '67, writes: "I am into my eighth year of 20 percent yearly growth directing McKinsey's practice in Mexico. I published a white paper on Mexican savings and capital formation in December 1992. Three of my five children are in college: Alina (Wellesley), and Dario (Harvey Mudd) graduate in June 1993. I much enjoyed features of the 25th reunion held June 1992, as well as the opportunity to meet good friends again."

From Toledo, Ohio, **Chuck Bland**, SM '80, reports: "I've got two children, Christopher, age 8, and Brittany, age 5. I was appointed corporate controller on

January 1st of this year at Owens-Corning Fiberglas." ... **Michael M. Schnitzer**, SM '79, sends word: "I left Putnam, Hayes, and Bartlett after 13 years, with several long-time colleagues, to start the North Bridge Group, a management consulting firm specializing in regulated industries." ... From Jenkintown, Pa., **Ellen Bard**, SM '80, reports: "My computer supplies business is functioning smoothly while I devote many hours (much below minimum wage!) to my work as an Abington Township commissioner. I also continue to try to keep alive the local environmental group I started three years ago. Our family pastime is hiking with six-year-old Allison." ... **Thomas Strother**, SM '84, sends word from Moorpark, Calif., where he lives and works: "I recently joined Demo Systems, Inc., as a program manager. Demo Systems designs and manufactures avionics equipment for commercial and military aircraft." ... We receive word from **Douglas Ward**, SM '66, in Midland, Mich.: "I was named director of accounting reporting and analysis for Dow Chemical Co. in September 1992. I returned from Canada, where I had been controller of Dow Chemical Canada." ... **Wayne Firsty**, SM '90, is living in New Britain, Conn. He writes that he is engaged to Beth London and a June 1993 wedding is planned.

Stephen Miller, SM '74, reports: "I continue to manage JSA International's aerospace and defense consulting practice in Cambridge. With a significant number of European clients, I spend a lot of my time traveling." ... **Steven Russell Kanner**, SM '74, writes: "I just completed a four-year project to develop Medical Master-the Doctor's Workstation, the first and only comprehensive software to support the entire practice of medicine. It is Macintosh based; medical center response is enthusiastic. Keep tuned." ... **Darryl K. Mikami**, SM '86, announces the birth of his daughter, Kendra Joy, on July 28, 1992. ... From Orono, Minn., **Bruce A.H. McFadden**, SM '75, writes: "During 1992 I have made a career shift, getting involved in starting a new company: Core Technologies, Inc., based on a technology license from a university. In early 1993 we expect to start operations in the Seattle-Tacoma area." ... **J.J. Kinley**, SM '50, sends word from Lunenburg, Nova Scotia: "My two sons, both engineers (one a naval architect and the other an MBA) have joined me in our family business (Lunenburg Industrial

Foundry) with excellent results. My wife, Grace, and I even had a vacation in Europe, a mixture of business and pleasure. I was honoured to receive the Canada 125 Medal." ... **Mark D. Terry**, SM '89, reports: "Still living in Boulder, working in Loveland at HP. Give me a call if you're coming through."

Mark F. Hayward, SM '85, sends an update: "I was recently named president of Medison America located in Fremont, Calif. A new joint venture between a successful high-tech start-up in Korea specializing in ultrasound imaging and my previous company, Circadian, Inc. Medison is flanking the top ultrasound companies by exploiting niche markets with cost-effective products. I expect to be among the top ultrasound companies within a couple of years. My wife, Mila, and I live in sunny San Ramon, Calif., with Kara (5), and Brendon (2)." ... **Subhash K. Batra**, SM '61 (II), SM '77, writes: "I received a grant from NSF to start a NSF State/IUCRC entitled Nonwovens Cooperative Research Center. As its director since September 1991, I have been immersed mostly with administrative matters, research, and teaching related to Nonwovens technology and products." ... **Claudia Baler**, SM '85, reports: "I left McKinsey & Co. (New York) and joined Becton Dickinson (Franklin Lakes, N.J.), a medical technology company, as director of corporate development. I am still living in New York, and am now engaged." ... **Paul S. Basile**, SM '72 (XVI), SM '75, writes: "I continue to commute. I work in Paris and live in London (on weekends). Life can be complex. The company in France, Computer Sciences Corp., is going through a real-life turnaround. I keep busy. And occasionally, I get to an MIT Club event in one of the two cities."

Marla Choslovsky, SM '88, and **Paul E. Greenberg**, SM '88, are delighted to announce the birth of their daughter, Talia Greenberg, on October 12, 1992. ... **Joe Heffernan**, SM '70, is president and CEO of Rothmans, Inc., in Toronto, Ontario. ... From Isa Town, Bahrain, where he is an assistant professor at the University of Bahrain, **S. Eggert Peterson**, PhD '70, sends word: "I am still following my interest in economic development. Came here in 1984 after 10 years in Eastern and Southern Africa." ... **Jacob Friis**, SM '90, writes: "During the week I am busy as a consultant with Symmetrix in Lex-

ington, Mass. My wife Hyan-A and I just bought an historic house from 1855 with a lovely view of Spy Pond and the Boston Skyline." ... From Coral Gables, Fla., we receive news from **Jorge R. Peschiera**, SM '75: "At JPBT Advisers, Inc., I am managing investment portfolios in less developed countries' assets, since July 1991." ... Reverend **Verne E. Henderson**, SM '79, is president of Reuehen Consultants in Brookline, Mass. He recently published *What's Ethical in Business?* (McGraw-Hill, 1992). ... From San Diego, **Rene A. Smith**, SM '78, writes: "Busy serving as general manager of Voice & Video, a small business—25 employees—that's 8 businesses in one. Quite a challenge, but fun. I look forward to hearing from any of my long lost friends from Sloan."

Frank Graves, SM '80, is working at Incentives Research, Inc. He and his wife, Christine, had a baby boy, Zachary Thomas Graves, on July 24, 1992, and live in Belmont, Mass. ... **Ken Pucker**, SM '90, is VP of manufacturing technology development at Timberland Co. in Hampton, N.H. ... **Paul R. Freshwater**, SM '68, sends news from Cincinnati, Ohio: "I helped to form the Southern States Waste Management Coalition, a public/private venture to develop data and policy guidance on integrated solid waste management for the governors of 16 southern states, Puerto Rico, and the Virgin Islands." ... From Malvern, Pa., **Djoerd Hoekstra**, SM '61, reports: "I retired from Elf Atochem North America, where I was VP for strategic planning, last year to join a new company, Biocoat, Inc., which licenses its patented technology for biocompatible coatings to medical device manufacturers. I am president and COO." ... **Carol L. Smith**, SM '92, writes: "I'm now a 'real' employee with Monsanto, in the Agriculture Group (Rich works for the Chemical Group). I spend my time helping the business units figure out what decision support tools they need to manage their organizations. It's a lot of fun and I'm working for another Sloanie—**Mark Trusheim**, SM '84. Come visit St. Louis!"

Eric A. Mitchell, SM '90, is director of planning and analysis at Tri-Star Pictures in Culver City, Calif. ... A correction: **Mark E. Martich**, SM '81, is chief engineer at Fisher Pierce (a division of Pacific Scientific) in Weymouth, Mass., not with Isotek AG in Switzerland as we earlier reported. **Shripad**

A MOTLEY CREW—Reuniting Management of Technology grads last December included:

Top Row: Josh Lindsay, '80 (II), Francis Song Chian Yeoh, SM '93, Professor James M. Utterback, PhD '69, Captain Audie E. Hittle, SM '91, Barney Ussher, SM '92.

Second Row: Gary D. Smolander, SM '91, Todd M. Moore, SM '91, Edward Y. Wong, SM '91, Roberto Gregori, Jr., SM '93, Christopher Firth, SM '93.

Third Row: Joseph M. Gilman, SM '90, Rosa Camino, SM '93, Tony Weighouse, SM '93, Professor Edward B. Roberts, '58, SM '58 (VI), SM '60, PhD '62 (XIV), Program Chair Harry Benz, SM '93.

Fourth Row: Roberta L. Zald, SM '90, Stephen E. Bello, SM '88, Masahiko Tsuchiya, SM '93, Nelson Martinez, SM '93, Alessandro Ungredda, SM '93, Antonio R. Flores, SM '90.

Bottom Row: Meir H. Zucker, SM '89, Melvin G. Arnold, SM '91, Jennifer Mapes, program coordinator, Rochelle Weichman, program director, Akio Mitsufuji, SM '89, Terry Leslie, SM '86 (VI).



Pendse, SM '67, sends word: "I edited and was cowriter of *Perspectives on an Economic Future: Forms, Reforms, and Evaluations* (Greenwood Press). A number of eminent economists, including Nobel Laureate Jan Tinbergen, present in this book their visions for future economic designs. My own chapter suggests that there be a minimum guaranteed income, and a maximum allowable income which would be a large multiple of the minimum. Having established a floor and a ceiling for income distribution, the government would abolish a number of laws currently on the books aimed at maintaining economic equity. I argue that these laws, though often based on good intentions, create great inefficiencies and bureaucracies, and often fail to achieve their stated purpose."



David Collins

David J. Collins, SM '59, president of Data Capture Institute of Duxbury, Mass., was recently awarded the Richard R. Dilling Award by the Automatic Identification Manufacturers (AIM USA). The award is made to an individual from within the 180 member companies for advancing the growth of the automatic data collection industry through new technological developments

and significant applications. In 1968 Collins founded Computer Identities Corp., of Canton, Mass., the first company to design and manufacturer modern bar-code scanning equipment, and served as president and CEO until 1986. Previously he was manager of the rail car identification program, the forerunner of the modern bar code, at Sylvania/GTE. Collins is a coauthor of the bar code industry's best-selling book, *Using Bar Code: Why It's Taking Over*. He is also editor of *Data Capture Case Studies and Technology* journal, which is published quarterly. Collins, who was a co-founder of AIM in 1972, holds several early bar-code scanning patents, and is a frequent guest lecturer and educator in automatic data collections technologies. . . . **Michael Richter, SM '71**, writes from North Caldwell, N.J.: "I have moved to a new assignment which will encompass coordinating re-engineering efforts at Lehman Brothers." Richter is senior VP at the New York City-based company. . . . **Gregory F. Zaic, SM '71 (II)**, SM '72, is a general partner in Prince Ventures in Westport Conn. He writes: "Prince Ventures focuses on financing medical start-up companies with venture capital (\$5-5.0 million). I'd be pleased to discuss suitable venture situations with classmates and their friends."

Sloan Fellows

William M. Zarkowsky, SM '58, writes from Milledgeville, Ga.: "I retired from Grumman Corp. after 46 years. I was vice-chair of the Grumman Corp., president of Grumman Eco Systems, and president Grumman Medical Corp. I have consulted major and small companies in USA, Europe, Asian Group, Japan, Taiwan, and Korea. I am enjoying home life, woodworking, stained glass, and gardening." . . . News arrives from **H.E. Fish, SM '61**, in Erie, Pa.: "Since retirement, I've become involved in elementary education, as a trustee and supporter of Erie Day School (Montessori and K-8th grade). It's worthy of the effort and helps to focus importance on a basic foundation of fundamental academics and development. MIT is helping because money I might give to MIT, now goes to EDS." . . . **Robert A. Nafis, SM '65**, lives in Greenlawn, N.Y., and works as a senior management consultant at Grumman. He writes: "I'll be fully retired in May, finally." . . . From Santa Monica, Calif., **Norman C. Peterson, SM '63**, writes: "I retired in 1985, and am now president of the local Protective Association (private patrol) with 750 households. I also do reviews of engineering and

scientific software for publication, and sing in a performance choral group." . . . **Pascal "Pat" F. Tone, SM '79**, reports: "I was married to Lynn McGrath on December 18, 1992, in Tucker's Town, Bermuda. I was also promoted to director of the Southwestern region of the Individual Asset Management group at Neuberger & Berman in New York City." . . . **Eugene D. Becken, SM '52**, sends word from Little Ferry, N.J., where he is commissioner of the Bergen County Utility Authority: "I am extensively involved in environmental matters—recycling, solid waste, sewerage, composting, incineration, in Bergen County, which has a population of about 850,000 and is next to New York City. My goal is to maintain a leadership role in these environmental areas."

Fred S. Wojtalik, SM '69, is a manager in the observatory projects office at NASA's Marshall Space Flight Center in Huntsville, Ala. . . . From Bloomfield, Mich., **Edward J. Zellner, SM '87**, reports: "I was promoted to general director of engineering and planning for the Cadillac Motor Car Division of General Motors and am part of Cadillac's executive staff." . . . **Tom Kelly, SM '70**, writes: "After 41 years in aerospace, I am retiring as president of the Space Integration Division at Grumman at year's end, and returning to Long Island (from Reston, Va.), where my wife, Joan, has kept our home and her job as director of Hutton House Lectures at Long Island University. Our six children are all married, and each has given us a grandchild, with two more on the way!" . . . From Ottawa, Ontario, **Thomas A. Eastland, SM '69**, sends word: "Our company, First Mark Technologies, Ltd., in cooperation with the Canadian Space Agency, just completed an exchange of 40 Ottawa-area and Russian high school students aimed at cooperation in space science. The students met cosmonauts and astronauts, talked to MIR, toured space facilities, and launched miniature rockets. This exchange marked the end of operations for the Peace-Train Foundation, a Canadian charitable organization founded nine years ago by First Mark Personnel to 'transform east-west relations from confrontation to cooperation.'" . . . **Richard E. Disbrow, SM '65**, retired in April as chair and CEO of American Electric Power Co. Inc., in Columbus, Ohio.

The Association of Alumni and Alumnae has been notified that **Donald L. Boyes, '41**, of Naples, Fla., died on November 5, 1992. No further information was provided.

Senior Executives

Brian Anderson, '89, writes: "I have been managing director for Sarawak and Sabah Shell companies since 1989 and hope to remain in beautiful, dynamic Malaysia for some time to come. My son is now at school studying industrial design in Paris and my daughter is still at school in Switzerland. It is fun being in a country which grows at about nine percent, and which looks set to remain a high-growth economy for the next few years, albeit at perhaps a lower rate." . . . From Salzburg, Austria, **Helmuth Schmölzer, '84**, reports: "After 18 years with the Klöckner organization—the last 12 years as CEO of Klöckner Austria—I decided to accept the post as CEO of Hydrotechnik Ges. mbH in Salzburg, a medium-size engineering company with activities in water technology, particularly in reverse osmosis and air-pollution control." . . . **Hermann G. Wiencke, '71**, sends word: "I retired from my position at Elektrisk Bureau A/S in 1987. I am now partner in a small management consulting firm, Senior Service A/L, in Oslo, Norway."

From Taiwan, **Howell S. C. Chou, '69**, sends a business card that lists him as chair of the board at China Data Processing Center, honorary president of the Computer Society of the Republic of China, and chair of the board of Fortune Information Systems Corp. He writes: "Since becoming chair of the board of directors, I have more time to see the world from the top to the southern most part for both technological and sight-seeing purposes." . . . From Japan, **Keiji Shimizu, '92**, reports: "After a six-year assignment in the New York Office, I have

finally returned to the Tokyo head office of Marubeni Corp. It was an unforgettable experience when I luckily joined in the Senior Executive Program at the end of my assignment in New York. I would like to thank all of my Spring '92 colleagues and send my bet wishes!" . . . **Evgenia R. Bogatova, '91**, writes from Moscow: "Since mid-1992, I have been general director of a research and consulting consulting company, RBM Eurokosmos. I am also editor-in-chief of the *Russian Business Monitor* (information review), and the author of a Russian TV series, *Algorithms*. I also give a course of lectures at the Academy of National Economy under the Government of Russia."

Joseph R. Aspland, '77, of Bedminster, N.J., died on December 4, 1992. He was president, chair of the board, and CEO of North Star Reinsurance Corp. in Florham Park for over five years, retiring in December 1991. Before that, he was employed by AllState Reinsurance Co. in North Brook, Ill., for seven years. He was an enthusiastic supporter of the opera, having been a member of the Boheme Opera Co. of Trenton, N.J., and serving as a charter member of the board of trustees since its inception in 1992. He served in the Army from 1946-48.

Management of Technology Program

Joseph Gilman, SM '90, and his wife, Susan, are excited to announce that they are expecting another child in August. Joe is director of International Operations at BellSouth Corp. in Atlanta, Ga. . . . **Barbara Proud, SM '90**, is coordinator for the Hospital Authority in Hong Kong, and continues to be busy computerizing the hospitals. She recently visited her son, Trevor, in Boston and stopped in the MOT program office, joining Rochelle Weichman and Jennifer Mapes for lunch. . . . **Roger B. Glovsky, SM '91**, has established a law practice in Northboro, Mass. Roger advises high technology and other emerging companies on business organization and finance. He is also the founder of Pro-Micro business forums in Boston and Worcester. . . . **Hiroyuki Oguwa, SM '91**, is staff assistant manager at Kawasaki Steel Corp., Chiba Works in Japan. . . . **James Brown, SM '92**, has returned to AEG Magnetbahn GmbH in Starnberg, Germany. He is working in industrial automation and corporate level strategic planning. . . . **Hiroshi Shiroy, SM '92**, an engineer with the City of Osaka, Japan, is looking forward to his marriage to Keiko Sato in June of 1993. . . . While on the MOT field trip, the class of '93 met up with alumni/ae in California and Mexico. In California the class visited **Ed Wong, SM '91**, and the Southern California Gas Co., and had dinners with **Wong, Carol Lemlein, SM '83 (VI)**, **Anita Kirkpatrick, SM '85**, **Rich Norton, SM '85 (I)**, and **Dave Aune, SM '88**. In Monterrey, Mexico, the trip was hosted by **Luis Rendon, SM '91**, and **Vitro, S.A.** The group was joined on the last night for a Mexican fiesta by **Jose Cardenas, SM '89**, **Antonio Flores, SM '90**, and **Luis Jimenez, SM '92**.

XVI AERONAUTICS AND ASTRONAUTICS

From Cambridge, **Dayl Cohen, SM '85**, writes: "I have recently left the Massachusetts Port Authority to start my own consulting firm. Dayl Cohen Associates specializes in airport planning and policy analysis, and is currently working on projects for Schiphol Airport in Amsterdam, The Netherlands, Boston's Logan International Airport, and Pease Airport in Southern New Hampshire." . . . **Carl Alexoff, SM '56**, reports: "I have formed Creative Games, Inc., to design, market, and implement a patented on-line lottery game that is played through remote retail terminals connected to a central computer, similar to Lotto. I recently retired from Webcraft Games, Inc., a specialty security printing company that I founded in 1981. I split my free time between Cherry Hill, N.J., and Northumberland County, Va." . . . **Robert A. Summers, SM '46, ScD '54**, writes: "I am now division chief in the

U.S. Arms Control & Disarmament Agency in Washington, D.C., where I am leading a program for defense industry conversion in Russia and other countries of the former Soviet Union." ... **Earle L. Messere**, SM '64, reports that he was selected as the technical director of the New Naval Underwater Warfare Center in Newport, R.I., in January 1992. ... From Newton, N.J., **Alan H. Midkiff**, SM '92, sends word: "I am currently flying as first officer on MD-11 aircraft for American Airlines. Mostly North Atlantic routes to European destinations from Chicago O'Hare."

Vivek Mukhopadhyay, SM '70, ScD '72, reports from Yorktown, Va.: "I joined NASA Langley Research Center as senior scientist in the Aeroservo-Elasticity Branch." ... **J. Cooper Shackelford**, '43, has retired as chair at Potter-Shackelford Construction Co., in Greenville, S.C. ... News from **Herman Schutten**, SM '64, in Milwaukee, Wisc.: "I left Eaton Corp. in 1989 to form my own consulting company (H.P. Schutten & Associate, Inc.), intending to relax and cut back on working time. As with all plans, it has not worked out that way. Since the beginning, it has been six days a week, and turning down new clients. The consulting involves solving instability problems in heavy duty construction and agricultural equipment, teaching courses in the practical aspects of non-linear control theory to the design engineers (of above equipment), designing automatic guidance (inertial) for warehouse AGVs, along with extensive work with clients in planning new products. Should have gone on my own years ago!" ... **Florian G. Leroux**, SM '45, sends word from Montreal, Quebec: "I still am a consulting engineer (ingénieur conseil) in the laundry and dry-cleaning field, which seems a far cry from aeronautical engineering, but that is another story, a long one..." Thank You!"

Satya N. Atluri, ScD '69, a Regents' Professor of Engineering and director of the Computational Modeling Center at Georgia Institute of Technology in Atlanta, sends us a long letter. He says: "In February 1991, during my visit to MIT as the Hunsaker Professor of Aeronautics, I suffered total renal failure, and have been on dialysis since then. I am happy to report that in November 1992 I received a renal transplant in Atlanta. I am doing very well now and am able to resume my normal life. I hope to put this God's gift of new life to good use and do some good through my teaching and research activities. In 1992, under a major funding from the Federal Aviation Administration, AFOSR, and the Warner Robbins Air Logistics Center, the first national 'Center of Excellence for Computational Modeling of Aircraft Structures' was established at Georgia Tech, under my direction. This Center deals with our nation's aging aircraft fleet, fracture and fatigue, multi-site-damage, crash-worthiness, structural integrity, repairs, life-enhancement, mechanics of advanced engineered aerospace materials, and damage tolerance, etc. I would like to invite recent Course XVI to spend some time at this center as postdoctoral fellows. If interested, please call 404-894-2758. In December 1992, I was invited to give the inaugural lecture, at the 50th anniversary celebrations of the Department of Aerospace Engineering at the Indian Institute of Science in Bangalore, India, where I received my first degree in aerospace engineering before I entered MIT. The title of my lecture was 'The Dawning of the Age of Designer Materials.' I was given a 'Distinguished Alumnus Award' at this celebration—a very satisfying feeling to be recognized by your alma mater. On December 21, 1992, the International Conference on Computational Engineering Science (ICES '92), awarded its newly initiated ICES Gold Medal to me. The citation reads for 'his seminal and sustained contributions to computational engineering science, and for his laudable service to the computational mechanics community.' ICES is an international organization that holds its conferences every two years and brings together about 500-600 leading scientists of the world in the area of computational mechanics."

Atluri's letter continues: "It should be of interest to the MIT community that ICES has also initiated three other medals to honor former and current

MIT faculty, and awarded them for the first time on December 21, 1992, in Hong Kong. The first is the T.H.H. Pian Medal, named after T.T.H. Pian, SM '44, ScD '48, Course XVI professor emeritus, in recognition of his pioneering contributions to hybrid and mixed finite element methods. The second medal is named after Eric Reissner, PhD '38 (XVIII), Course XVIII professor at MIT from 1939-69, and now professor emeritus of applied mechanics at U.C. San Diego in La Jolla, Calif., to recognize his legendary contributions to variational principles and mechanics of solids that are germane to modern computational mechanics. The first Eric Reissner medal was awarded to Lallit Anand, MIT professor of mechanical engineering, for 'his outstanding contributions to the mechanics of materials over the past decade.' The third medal is named after **Kyuchiro Washizu**, '54, the late professor of aeronautics at the University of Tokyo. Washizu was a visitor to MIT's Department of Aeronautics in 1955 when he wrote the celebrated report on what is now known as the 'Hu-Washizu Variational Principle.'

XVIII MATHEMATICS

Jørgen E. Harmse, PhD '89, writes: "Taught at UT Austin for three years after graduating. Now working on decision support and data fusion for Tracor, Inc., in Austin." ... **David Harbater**, PhD '78, reports: "I am currently a research professor at the Mathematical Sciences Research Institute in Berkeley, Calif., while on a sabbatical from my professorship at the University of Pennsylvania's Mathematics Department." ... **Jeremy A. Bloom**, SM '76, PhD '78, sends word: "I am now manager of the integrated resource planning program at the Electric Power Research Institute in Palo Alto, Calif. I am responsible for helping electric utilities integrate energy conservation programs with plans for generating plants. Previously I worked for General Public Utilities in New Jersey for 10 years."

The Association of Alumni and Alumnae has been notified that **Roger R. Crane**, SM '51, of Milano, Italy, died on August 19, 1992. No further information was provided.

XX APPLIED BIOLOGICAL SCIENCES

The Association of Alumni and Alumnae has been notified that **Philip M. Leung**, PhD '65, of Davis, Calif., died on January 4, 1992. No further information was provided.

XXI HUMANITIES

Howard R. Bartlett, of South Harpswell, Maine, died on December 27, 1992. Bartlett was a professor emeritus of history at MIT and former head of the Humanities Department. He headed that department from 1938 until he relinquished his administrative duties in 1963 so he might return to teaching, which he did full-time until retiring in 1967, and then stayed on as senior lecturer until 1970. Bartlett came to MIT in 1929 as an instructor in what was then called the Department of English and History and which later became the Department of Humanities. He became a full professor in 1940. His service as department head saw the establishment of the school of humanities and social science in 1950, and the establishment of a double major in humanities and science, or engineering in 1955. The culmination of Bartlett's work as an administrator and teacher came in 1966 when MIT established a humanities major. Bartlett began his scholarly career by studying American economic history and later concentrated on contemporary social and political history, including that of

other cultures. He tried to evaluate the changes wrought by technology and the manner in which cultures adjust to such changes. In 1963, Bartlett, while a consultant to the Ford Foundation, helped to establish the Birla Institute of Technology and Science in Pilani, India. In 1958, Bartlett and his wife, Helen, moved into Burton House, as the first step in a program that evolved into today's successful house master systems in which all MIT dormitories have house masters and tutors.

XXII NUCLEAR ENGINEERING

Charlie Larson, ScD '59, writes: "retired in 1992 after 32 years working as an engineer in the nuclear power industry—providing safe, reliable, and clean nuclear power to light our lights and power our economy. I still consult half-time and spend two days a week in tutoring programs at school and after school in East Palo Alto, Calif. The kids in EPA, mostly minorities, have a high drop-out rate in high school and I am trying to encourage students to stay in school and get that education that is



Roderic Pettigrew

so important in today's world." ... **Roderic I. Pettigrew**, PhD '77, director of cardiovascular imaging research at Emory University, has accepted an invitation to serve on the National Institutes of Health (NIH) panel which reviews applications for research grants in the field of radiology. Pettigrew, associate professor of radiology at Emory School of Medicine, will serve a four-year

term on the Diagnostic Radiology Study Section of the Division of Research Grants. Pettigrew, no stranger to the NIH application process, is currently principal investigator of a \$900,000 NIH grant for "Quantitative Stress Cine MRI for Ischemic Heart Disease." Pettigrew is known for his work at Emory involving dynamic cardiac imaging using magnetic resonance. His three-dimensional, gated MR images of a heart "beating" are among the first in the world. His work has led to his being featured on the Discovery Network, CNN News, and being listed in the very first issue of *Best Doctors in America*.

XXIV LINGUISTICS AND PHILOSOPHY

Traditionally, the study of language at MIT has been pursued separately as part of linguistics and as part of psychology. Now, in a first for MIT, Course XXIV and the Department of Brain & Cognitive Science, have undertaken a joint project to give five graduate students intensive research training in language structure, acquisition, and use. It's being done under a \$1.3 million, five-year NSF grant for programs that train students in rapidly advancing areas requiring knowledge of different academic disciplines—in this case, linguistics and psycholinguistics. **Kenneth N. Wexler**, Course IX professor, and **David Pesetsky**, PhD '83, Course XXIV associate professor, head the project.

TPP TECHNOLOGY AND POLICY PROGRAM

Kevin Fitzgerald, SM '86, is now in his third year of a doctoral program at the University of Pennsylvania. He reports an excellent summer spent in

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Vienna, Austria, at the International Institute for Applied Systems Analysis (IIASA)—way to go for an ex-TA in systems analysis!... **Benoit de Vitry**, SM '87, and his wife, Celia, are expecting a child soon.... **Nibras El Fadel**, SM '89, has been promoted to director of telecommunications activities in Andersen Consulting in Paris.... **Dava Newman**, SM '89, PhD '92 (XVI), is enjoying her first faculty appointment at the University of Houston in Texas.... **Annette Elton**, SM '90, is currently a second-year law student at New York University. She has accepted a summer position at a large law firm in San Francisco called Heller, Ehreman, White & McAuliffe. Annette has also recently become engaged to Greg Beitel—they plan to marry after the bar exam.... **James "Jamie" Winebrake**, SM '91, is finishing up PhD coursework at the University of Pennsylvania's Center for Energy and the Environment and is in the process of defending his dissertation proposal. He recently got married and he and his wife are expecting their first child in May. Congratulations!... **Roger Alexander**, SM '91 (VI), SM '91, has informed us that he has been accepted to the PhD program at George Washington University Graduate School of Arts and Sciences. His study emphasis will be in the area of telecommunications economics.... **Joe Raguso**, SM '91, is still at the Office of Technology Assessment. He reports that it has been a very busy six months since finishing a report at OTA entitled "Green Products by Design: Choices for a Cleaner Environment" at the request of the House Committee on Science, Space, and Technology and the Energy and Commerce Committee.... **Michael Berube**, '89 (I), SM '92 (XV), SM '92, and Michelle Tucci (sister of fellow TPP, **Chris Tucci**, SM '92), are getting married on May 15, 1993. Congratulations to all!... A rumor is spreading that **Michael Sullivan**, SM '92, is engaged. Is it true?... **Frank Koller**, SM '71 (I), is the producer with *Sunday Morning*, the national weekly documentary program on CBS Radio. Last winter, CBS Television "borrowed" him for three months to assist in the production of a one-hour network special program exploring the economic challenges for Canada in the new Asia.—Richard de Neufville, TPP, MIT, Room E40-252, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

William D. Neuberg, '17; December 10, 1992; Darien, Conn.
Frank Maconi, '20; December 24, 1992; Southborough, Mass.
Theodore M. Edison, '23; November 24, 1992; West Orange, N.J.
R.P. Owenshine, '23; July 14, 1992; Bloomfield, Mich.
Philip Cohen, '24; November 30, 1992; Cambridge, Mass.
John R. Kimberly, '26; December 20, 1992; Easton, Md.
Richard L. Cheney, '27; December 16, 1992; Santa Barbara, Calif.
Lincoln K. Davis, '27; December 24, 1992; South Easton, Mass.
Edward J. McCabe, Jr., '27; November 23, 1992; Cambridge, Mass.
B. Alfred Carideo, '30; December 13, 1992; Natick, Mass.
Robert M. Nelson, '30; September 26, 1992; La Cresenta, Calif.
Charles A. Bicking, SM '31; November 26, 1992; Rockville, Md.
Cecil Boling, '32; December 5, 1992; Naples, Fla.
Joseph W. Cogan, '32; 1976
Albert D. King, '32, SM '33; November 25, 1992
W. Cooper Cotton, '33; 1992; Columbia, Mo.
Forrest P. Dexter, Jr., '33; December 29, 1992; Farmington, Me.
David B. Smith, '33, SM '34; December 3, 1992; Gladwyne, Pa.
Richard F. Zimpel, '33; July 16, 1992; Johnstown, N.Y.

E. Enar R. Eskilsson, SM '34; July 7, 1990; Uppsala, Sweden
Orrington E. Dwyer, SM '36; December 1, 1992; Brunswick, Me.
William F. Lewis, '36; December 27, 1992; Oceanside, Calif.
Charles A. Blessing, '37, MCP '39; December 17, 1992; Detroit, Mich.
James P. Pollock, '38, SM '40; October 25, 1992; Hendersonville, N.C.
Wilbur C. Rice, '38; December 12, 1992; Bennington, Vt.
B. Allen Monderer, '39; September 24, 1992; Denver, Colo.
Meredith C. Wardle, '39; March 29, 1992; Nome, Alaska
John T. Kirk, Jr., '40; December 14, 1992; Short Hills, N.J.
Maxwell M. Small, '40; July 1, 1992; Bellport, N.Y.
Ferdi B. Stern, Jr., '40; December 27, 1992; Wayland, Mass.
Donald L. Boyes, '41; November 5, 1992; Naples, Fla.
Barbara E. Fisher, '41; November 11, 1992; Longmeadow, Mass.
Wei Pang Han, SM '41; July 30, 1992; Mississauga, Ontario, Canada
Ralph C. Wilts, '41; December 21, 1992; Boothbay, Me.
Karl G. Baresel, '42; December 29, 1992; Hanson, Mass.
Henry C. Meiners, ScD, '42; December 23, 1992; Palos Verdes Estates, Calif.
Ronald E. Shanin, '42; September 3, 1992; Huntsville, Tex.
Ming Lee, '43; November 27, 1992; Kowloon, Hong Kong
John L. Neal, '43; December 4, 1992; Akron, Ohio
John D. MacBeth, '45; November 21, 1992; Vero Beach, Fla.
Thomas Hennessey, SM '46; November 21, 1992; Dedham, Mass.
Charles R. Butler, '47; July 19, 1992; Makati Rizal, Philippines
Howard Grekel, SM '47; November 26, 1992; Houston, Tex.
John F. Michel, SM '47; November 14, 1992
Sonja K. Gross, '50; November 17, 1992; Waltham, Mass.
Paul H. Stelson, PhD '50; July 19, 1992; Oak Ridge, Tenn.
Roger R. Crane, SM '51; August 19, 1992; Milano, Italy
John P. Dowds, '51; December 10, 1992; Oklahoma City, Okla.
Haig K. Takvorian, '51; November 23, 1992; Glastonbury, Conn.
Robert L. Bondurant, '53; July 10, 1992; Corinth, Miss.
Etta M. Horblit, '53; September 1, 1992; Roslindale, Mass.
J. Philip Bromberg, '56; December 9, 1992; Pittsburgh, Pa.
Louis B. Seigle, '58; December 26, 1992; Houston, Tex.
David M. Kaetzel, SM '59, NE '59; November 12, 1992; Sumatra, Indonesia
Philip M. Leung, PhD '65; January 4, 1992; Davis, Calif.
George R. Steele, '65; April 1, 1992; Seattle, Wash.
Juliet S. Stanley, '68; 1973
Paul L. Hallowell, PhD '71; October 9, 1992; Ashton, Md.
David Nai-Chee Tso, SM '74; July 22, 1992; Houston, Tex.
Dave A. Campbell, SM '75; January 2, 1992; Irvine, Calif.
Joseph R. Aspland, '77; December 4, 1992; Westminster, N.J.
Mark J. Waltch, PhD '77; November 30, 1992; Cambridge, Mass.
Peter I. Berke, '78; November 15, 1992; Santa Monica, Calif.
Guy M. Emanuel, '79; August 20, 1991; Lithonia, Ga.
Thomas R. Colten, '80; August 22, 1992; Wilmette, Ill.
Robert J. Weinstein, '82; January 20, 1986; Saint James, N.Y.
Lawrence J. Dunn, '83; November 21, 1992; Fort Worth, Tex.
Dimitri N. Kazarinoff, '85; November 1991

Dances with Words

I have some very sad news to pass along. A friend of our long-time correspondent Robert High found my name in his files and phoned me to report that he was killed on 8 January while white-water rafting in Chile. Apparently High was quite an adventurer and the expedition was considered daring. I shall miss him.

On a more pleasant note Harold Boas read our January speed problem in which one cancels the 6s to show that $64/16 = 1/4$ and remarks that his father, the well-known mathematician R.P. Boas, wrote a paper on this subject that appeared in the 1979 MAA volume entitled *Mathematical Plums*, edited by Ross Honsberger.

Problems

M/J 1. We start with a Bridge Problem that Tom Harriman calls "Superwiener."

		North	
		♠ 10 9 8 7 6	
		♥	
		♦ A K	
		♣ A 10 9 8 7 6	
West		East	
♥ 9 8 7 6 5 4		♠ 5 4 3 2	
♦ 6 5 4 3 2		♥ K Q J 10	
♣ 3 2		♦	
		♣ K Q J 5 4	
		South	
		♠ A K Q J	
		♥ A 3 2	
		♦ Q J 10 9 8 7	
		♣	

M/J 2. Richard Kluger asks the "surname problem." A hypothetical planet contains n males with n distinct surnames married to n females. In this and all future generations, all females marry, assume their husbands' surnames, and bear 2 children who mature, marry, etc. A child has a 50% chance of being female. How many distinct surnames exist after k generations? Couples with

identical surnames, including siblings, can marry but transgenerational marriages are not possible.

M/J 3. John Prussing needs help in stalking a drug runner.

A Coast Guard skipper named Pedro is stalking a drug runner named Biff. Both boats are at rest separated by a distance a . A fog rolls in and Biff flees in a constant but unknown direction at a speed b . Pedro knows the values of a and b and the fact that his boat is twice as fast as Biff's.

- Determine a simple pursuit strategy which will guarantee that Pedro will intercept Biff in a finite time.
- Determine the minimum and maximum possible intercept times (the intercept time will vary depending on the direction Biff flees).

Speed Department

Here's one Winslow Hartford found in a British newspaper. Five Wrens were standing in the crowded mess on HMS *Seaworthy* during an evening's get-together and dance. The ladies' "excuse-me" was about to come up, causing some discussion among the five. Brenda rather liked the petty officer with the ginger hair, Norma fancied the able-seaman with the green eyes, Linda wanted a helicopter pilot, Enid had her eye on a six-foot marine, while Rachel was secretly determined on the Captain himself. Next day, the five women gathered for critical discussion. "That's odd," said Rachel, when the names of their dancing partners became known. "If each of us adds a different letter of Wrens to her own name, and rearranges the letters if necessary, she gets her man's name." What were their partners' names?

Solutions

JAN 1. Edward Wallner sent us the following problem from "the gamesman" column in *IEEE Potentials*, where it was credited to Cindy Furst. Ms. Furst claims that every electrical engineer should be able to fill in the four blanks:
10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, _____, 100.

Violet Devoe notes that the numbers are the standard values of capacitors and resistors and the missing entries are 68, 75, 82, 91. I guess she

should know since, in addition to being the mother of two MIT grads, Ms. Devoe is the president of Presidio Components, a USA manufacturer of capacitors.

JAN 2. Temple Patton has a plot of land in the form of a right triangle with all sides an integral number of feet. If the short side is 30 feet, what is the area? What if the short side is 31 feet?

Tom Eggers writes that there are three triangles with short side 30, having areas of 1200, 2160, and 6720. There is only a single such triangle with a side of 31, and its area is 14880.

The general solution for right triangles with integer sides is to solve $x^2 + y^2 = z^2$ in integers. All the solutions for that equation are found by choosing integer values for u and v in $x = 2uv$; $y = u^2 - v^2$; and $z = u^2 + v^2$.

Also, if a side of 1, 2, 3, 5, 6, 15, or 30 can be found with some values of u and v , then the resulting side (and its triangle) can be scaled up to provide a solution.

First look for solutions of $y = u^2 - v^2 = \{1, 2, 3, 5, 6, 15, \text{ or } 30\}$. A little straightforward work will show that: $\{u=2, v=1\}$ results in a 3, 4, 5 right triangle which scales to 30, 40, 50; $\{u=3, v=2\}$ results in a 5, 12, 13 triangle which scales to 30, 72, 78; $\{u=8, v=7\}$ results in a 15, 112, 113 triangle which scales to 30, 224, 226; and $\{u=4, v=1\}$ results in a 8, 15, 17 right triangle but 30 is not the short side after scaling.

Next, look for solutions of $x = 2uv = \{1, 2, 3, 5, 6, 15, \text{ or } 30\}$. A little more straightforward work finds: $\{u=1, v=3\}$ results in a 6, 8, 10 triangle which scales to 30, 40, 50, a duplicate; and $\{u=1, v=15\}$ results in the triangle 30, 224, 226 without any scaling, another duplicate.

So there are three right triangles with a short side of 30: 30, 40, 50 has an area of 600; 30, 72, 78 has an area of 1080; and 30, 224, 226 has an area of 3360. We'll hope Temple Patton owns the last plot.

There is only one solution for a side of 31: The triangle 31, 480, 481 has an area of 7440. If one of the legs is a prime, then there is only a single solution: $2uv = \text{prime}$ has no (useful) integer solutions, and $u^2 - v^2 = \text{prime}$ has only one solution, $u = (\text{prime} + 1)/2$ and $v = (\text{prime} - 1)/2$.

Better Late Than Never

A/S 1. As noted by several readers, Black can escape with 5 ... K-B6. Eugene Sard remarks that an extra White pawn on Q2 solves this.

Other Responders

Responses have also been received from J. Abbott, M. Astelfi, F. Carbin, E. Cummings, S. Feldman, M. Fountain, R. Hedrick, R. Hess, T. Lewis, M. Lindenberg, T. Maloney, E. Margulies, N. Markovitz, F. Model, A. Ornstein, D. Patter, A. Peralta-Maninat, K. Rosato, C. Rozier, J. Rudy, S. Shapiro, T. Shepard, A. Silva, A. Silva, L. Steffens, H. Ungar, J. Uretsky, and M. Weinstock.

Proposer's Solution to Speed Problem

Brenda + R gives Petty Officer BERNARD
Norma + N gives Able Seaman NORMAN
Linda + E gives Helicopter Pilot DANIEL
Enid + W gives Marine EDWIN
Rachel + S gives Captain CHARLES.



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: GOTTLIEB@NYU.EDU

DONORS' PROFILE

MR. AND MRS. WILLIAM H. ENDERS

HOME: Gilford, New Hampshire

CAREER: With an S.B. (1950) and an S.M. (1951) from MIT in aeronautical engineering, Mr. Enders first worked in fighter aircraft design at MIT and then in missile systems as a first lieutenant in the U.S. Air Force. In 1954, he joined Aeronca Manufacturing Corporation as chief development engineer and went on to a career in new product development and marketing. With RCA, he worked on ballistic missile defense, marketing of research programs, and video disc development, rising to the position of director of advanced product planning. With Magnavox, he was instrumental in bringing to the marketplace the first video game, Odyssey, whose success launched the home video game business. After serving as the vice president and general manager of Admiral International, a subsidiary of Rockwell International, he became vice president of marketing of GTE's Consumer Electronics, where he directed the market research that contributed to the FCC's approval of the standards for stereo sound for television. He retired in 1988.

Bill and Jean Humphrey married in 1951. They have lived on the shores of Lake Winnepesaukee since 1988, where they enjoy tennis, cross-country skiing and walking. They have a son and a daughter.

GIFT OF CAPITAL: The Hugo E. Enders Scholarship Fund.

QUOTE: Hugo Enders, my father, came to the United States from Germany in 1909, and worked in optics and mechanical engineering, earning numerous U.S. patents. Believing very strongly in the value of a good education, he paid my way through MIT. It is my hope that this scholarship fund in my father's name will benefit future MIT students and memorialize my father as a benefactor of a superlative education.

For more information about gifts of capital, write or call D. Hugh Darden, W. Kevin Larkin or Frank H. McGrory at MIT, 77 Massachusetts Avenue, Room 4-234, Cambridge, Massachusetts 02139-4307; (617) 253-3827.

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The Smart Way to Make Materials

By JULIAN SZEKELY



MEDIEVAL swordsmiths knew little of the physics or chemistry of the metals that they repeatedly hammered, heated, and quenched. What they had was empirical knowledge handed down from master to apprentice and perhaps slowly refined over time.

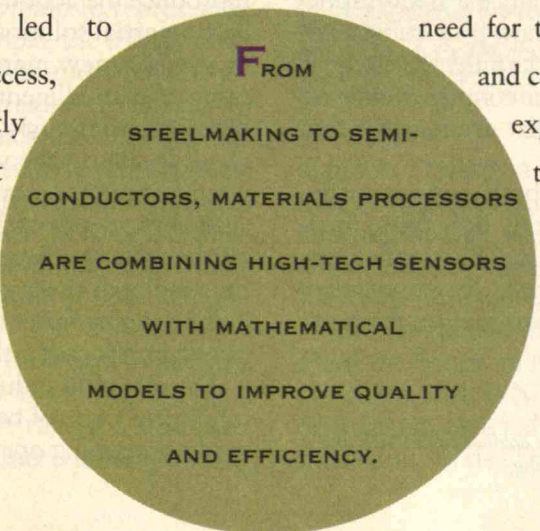
Progress in the intervening centuries has been less dramatic than might be imagined. Although computers now run many materials-processing operations, they rely mainly on empirical information—they are programmed essentially to maintain a prescribed set of conditions, such as temperature and pressure. While this method has led to remarkable success, it is inherently limited by past experience.

Overcoming these limita-

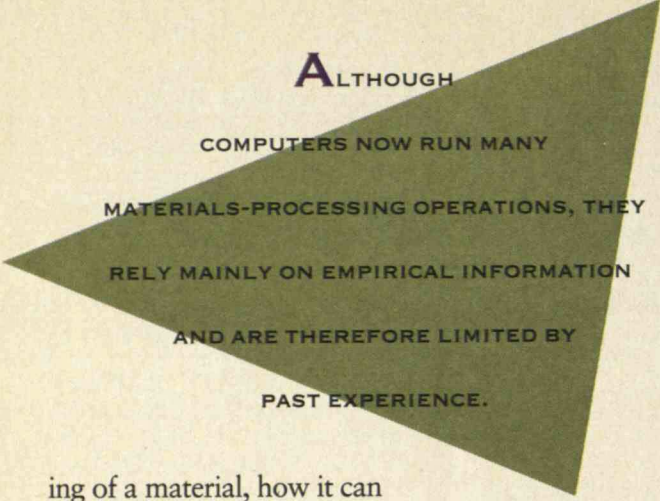
tions is the goal of the new technology of intelligent—or knowledge-based—processing of materials. The basic aim of this approach is to organize knowledge in an accessible form and use it to improve process control, boost productivity, and, ultimately, make superior products.

At the heart of intelligent processing are mathematical models that quantitatively relate a material's properties, such as strength and flexibility, to its internal structure. The models also explain how this structure depends on the conditions under which the material is produced. The goal is to devise models that apply to a broad class of materials, reducing the

need for time-consuming and costly laboratory experiments every time a new process emerges. By fostering a better understand-



FROM
STEELMAKING TO SEMI-CONDUCTORS, MATERIALS PROCESSORS
ARE COMBINING HIGH-TECH SENSORS
WITH MATHEMATICAL
MODELS TO IMPROVE QUALITY
AND EFFICIENCY.



ALTHOUGH
COMPUTERS NOW RUN MANY
MATERIALS-PROCESSING OPERATIONS, THEY
RELY MAINLY ON EMPIRICAL INFORMATION
AND ARE THEREFORE LIMITED BY
PAST EXPERIENCE.

ing of a material, how it can be made, and how it behaves, intelligent processing should also make possible much more accurate control of processes now in use.

Materials processing ranges from the production of commodities materials such as steel, aluminum, glass, cement, and polymers to the manufacture of specialty materials such as silicon or gallium arsenide for the computer industry, composite aircraft components, and optical fibers for telecommunications. The operations required to produce these two types of materials are very different. Commodities are produced in quantities measured in hundreds of thousands or even millions of tons each year. The capital investment is large, operations tend to be inflexible, and long-term changes are difficult to implement. Indeed, in concept, the basic technologies used to produce steel, glass, and aluminum have not changed much over many decades. Productivity is the critical issue: arranging the production line to minimize the costs of energy, labor, and raw materials. There is little incentive to improve quality past a basic requirement.

With specialty or "boutique" materials, the scale of production is much smaller but the dollar values are comparable: a single three-inch wafer of gallium arsenide is worth about as much as a ton of finished steel. Because quality and performance are all-important, engineers continually develop new processing techniques for these materials. The capital investment required is much smaller than in the tonnage materials industries, so changes in equipment are feasible and indeed constitute a fact of life.

Intelligent processing can benefit both segments of the materials industry. For the commodity industries, intelligent processing should improve production efficiency, lowering costs. For high-tech materials, the knowledge-based approach might yield new production methods and, possibly, novel materials.

JULIAN SZEKELY is a professor of materials engineering at MIT and a member of the National Academy of Engineering.

The Intelligence Advantage

All process-control arrangements, from a household thermostat to a smart-bomb guidance system, work basically the same way. Sensors monitor conditions such as temperature, pressure, and chemical composition, and the process is adjusted to correct any discrepancy between these measured values and the desired settings. In intelligent processing of materials, data obtained by sensors are not used directly, but are instead processed or manipulated by mathematical models that perform calculations based on equations that describe the process and the material's structure. The results of these manipulations—rather than the raw output from the sensors—controls the process.

Processing materials entails transforming a fluid—either gas or liquid—into a solid of the desired shape and structure. To properly manage this transformation, we need to account for the nature and speed of chemical changes and the dynamics of fluid flow and heat transfer. We also need to know the relationships between a material's internal structure and its properties. This kind of information is often either unavailable or only partially used.

Consider, for example, welding two pieces of metal. This complex process involves the transfer of heat from a welding arc, melting, circulation within the molten material, and the heating of a much larger region around the weldpool. The person holding the welding torch typically has little awareness of these complex phenomena at a fundamental level but will have accumulated a great deal of practical knowledge. The technical specifications for the welding operation will typically have been set by engineers with minimal input from the actual operators.

Robotic welders have become commonplace, particularly in automotive factories, but these robots merely reproduce the action of experienced welders. This is at best a partial solution; every change in workpiece size, or use of a new material, requires costly reprogramming. An intelligent welding machine, by contrast, would continuously monitor the temperature at various key sites in the weldpool. A mathematical model would compute from these readings critical information such as the depth of the weldpool and the thermal stress on the materials being joined. The robot could then use the results of these computations to guide its work—perhaps going faster or slower or delivering heat in patterned bursts rather than continuously.

The materials industry has so far made limited use of intelligent control because the harsh environments of many processing operations make it difficult to contin-

uously measure temperatures and monitor composition. Steel is made at around 1,600 degrees Celsius; silicon melts at around 1,420 C.

Recognizing the potential of intelligent processing, the U.S. Department of Energy and the American Iron and Steel Institute have combined forces in an ambitious \$50 million program to develop and implement novel sensing and control strategies for the steel industry. In one project, for example, the Los Alamos National Laboratory and Bethlehem Steel are collaborating to develop a fiber optic system to monitor temperatures in a basic oxygen furnace. The fibers transmit light and infrared radiation from the furnace to sensors kept at a safe distance; the system computes temperature based on the distribution of energy in the spectrum. Such continuous monitoring of the furnace will allow much better process control.

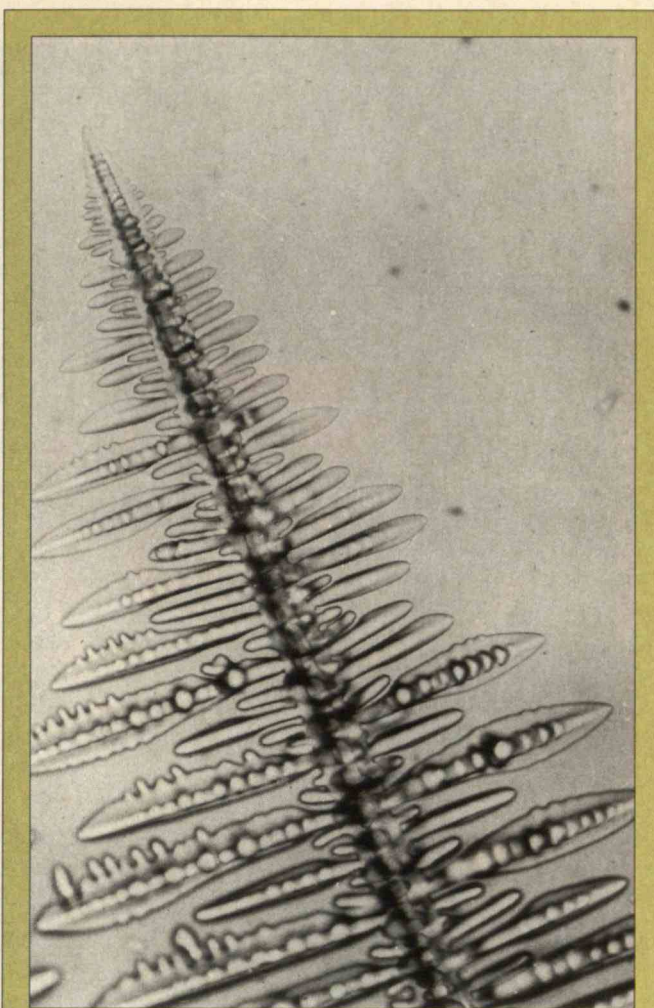
Other remote sensing technologies are also being developed. Magnetic sensors can detect the level of molten metal in a closed container, for example, and lasers can measure a piece of material's shapes or dimensions. So-called eddy current sensors induce a current in a material specimen; the resulting magnetic field will be affected by surface defects and the porosity of the material.

Even with such methods, some of the most important characteristics of a material are difficult to sense directly during processing. What is the microstructure? Is it crystalline or amorphous? If it is a crystalline, what is the atomic arrangement, and how large are the crystal grains? Such information may be deduced from measurements processed by mathematical models.

There are two basic types of mathematical models. Empirical models are compiled from experimental observations. Mechanistic models are derived from scientific principles. Both are important in intelligent materials processing.

Empirical models provide a formalized representation of experience. Take, for example, the transformation of 200-millimeter-thick steel slabs into 1-millimeter-thick sheets. A rolling mill requires several stages to produce a sheet of the specified thickness and with the desired microstructure, bulk, and surface properties. A model based on accumulated experience determines the number of times the steel passes through the mill, the reduction per pass, and the temperature at which this deformation has to take place to yield acceptable quality.

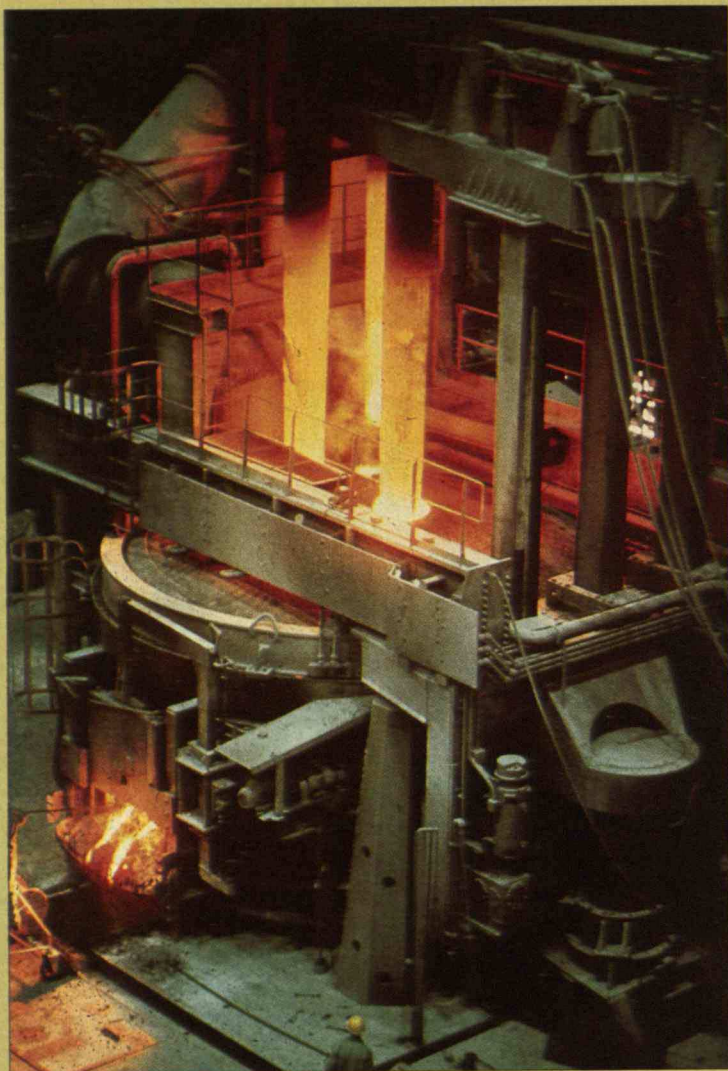
But there is no guarantee that past experience has ever achieved the best conditions. In rolling, a 4-pass process might have worked better than a 2-step process—but clearly there are many more possibilities to



The properties of many aerospace alloys depend on the spacing between the "branches" of their Christmas-tree-shaped crystals. An intelligent processing system relies on a model that precisely relates this spacing to the conditions under which the material is produced.

explore. Perhaps a 7-step or even a 17-step process might prove even better. Or maybe temperatures should increase 10 degrees during each successive rolling operation. Industry does not have the resources to conduct such wide-ranging experiments for every material.

Mechanistic models can help supply this information. These are based on fundamental chemical and physical principles, such as Newton's laws of motion and the theory of chemical equilibrium, that govern the behavior of fluids and solids. The powerful and inexpensive com-



This electric arc furnace, which melts and refines scrap steel, depends on an intelligent control system to raise efficiency. Such systems also prolong electrode life and lower energy consumption.

puters that have become available during the past decade allow us to solve the complex differential equations that embody these laws, giving us a fundamentally based representation of many physical phenomena. We can use this knowledge to accurately calculate the distribution of temperatures, velocities, and magnetic fields in molten materials, their rates of melting and solidification, and the mechanical stresses that they experience under a variety of conditions.

By sharpening our fundamental understanding of a process, a mechanistic model enhances our ability to control it. Fundamental analysis of steelmaking, for example, suggests that intense agitation of the molten iron accelerates its transformation into steel; modern steel plants armed with this insight now can accomplish in 30 minutes what used to take 12 hours. In steel casting, modeling may allow us to significantly improve the quality of the solidified metal produced by strong stirring or agitation while it freezes. In other processes, production of material of the desired quality may require that the melt be kept essentially motionless using a strong electromagnetic field. Modeling provides quantitative understanding of these phenomena so that we know in which direction to head.

For example, attaching a single microprocessor to an electronic circuit board requires as many as several hundred reliable solder connections. Yet even the conceptually straightforward question of what is the shape that a molten solder bead tends to take when deposited between a lead wire and a copper pad has for many years gone unanswered. My laboratory recently developed a computer model that calculates the complex shapes of these beads. This information should permit designers to more intelligently decide how closely spaced the leads can be, and how much solder is needed to provide a reliable connection without shorting out the adjacent connections. The dynamics of how to deposit the solder paste and what kind of thermal stresses evolve during the process have not yet been fully addressed.

Although the output of mathematical models is numerical, the insights gained are often qualitative. The formation of metallic or ceramic coatings provides a good example. This process entails spraying molten

droplets onto a solid (or at times molten) surface. The quantitative understanding of how these droplets flatten or spread on impact, and how the impact velocity affects the spreading and adhesion process, is of major significance. Indeed, it has led to the development of an entirely new technology: the high-velocity oxygen fuel process, where droplets are driven at the substrate at supersonic speed, yielding better coatings than those produced by conventional methods.

From Steel to Semiconductors

Intelligent processing has so far been applied mostly in the tonnage materials-processing industry. In Japan several steel companies, including Nippon Steel, Kawasaki Steel, Kobe, and Sumitomo—are now operating large computer-controlled iron blast furnaces. Iron ore, coke, and flux materials are fed into the top of the furnaces—structures up to 10 meters in diameter and 30 meters high—while hot air enters at the bottom. The solid material gradually descends, reacts, and melts, yielding hot pig iron and molten slag that is continuously tapped at the bottom. A typical iron blast furnace may produce up to 10,000 tons of hot metal per day valued at \$1.5 million, or over \$500 million a year.

The main issues in blast furnace operation are the efficient use of coke (the most costly of the raw materials) and the quality of the hot metal output. Japanese operators have been able to achieve close to optimum conditions by fitting the blast furnace with numerous sensors that measure the temperature and composition of the gas. The operators correlate these readings to the system's performance. The steel companies also used a great deal of fundamental mathematical modeling to represent the process chemically and physically, taking into account reaction rates, fluid flow phenomena, and heat transfer. The payoff—a rule-based engineering approach that enables a computer to efficiently control the blast furnace—has been substantial. Intelligently controlled blast furnaces may consume 5 to 20 percent less coke than conventional systems, producing corresponding cost savings.

Although still trailing the Japanese appreciably in intelligent processing, the U.S. steel industry is beginning to adapt the technology. Some U.S. rolling mills and continuous casting operations use intelligent processing to improve metal microstructure and surface quality, reduce the number of unacceptable pieces, and save energy and labor—all implicated in the precipitous loss of market share by U.S. producers in the 1970s and 1980s.

It is a healthy sign that these trends are now being reversed; the U.S. steel industry in general has become cost-competitive, and the so-called minimills in particular are technology leaders. Chaparall Steel, a successful minimill operator in Midlothian, Tex., relies on intelligent processing to optimize its electric arc furnace systems. Chaparall uses an electric arc of up to 100 megawatts to melt and refine scrap steel, which is then formed into various components.

While they offer important environmental advantages, arc furnaces are still far from being optimized. It

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is difficult to maintain a stable arc that doesn't "flare," and the electrodes wear out quickly. Chaparall Steel adopted a sophisticated computer control technique that carefully balances the phases of the electrical current and the positions of the electrodes to promote stability. This has resulted in appreciable energy savings. The technology in use at Chaparall originated in Mexico, but a similar system is being developed in the United States by Milltech-OH of Davenport, Iowa.

Semiconductor fabrication presents another challenge. To produce single crystals of silicon and gallium arsenide, a crystal is slowly pulled out of a melt contained in a cylindrical, rotating crucible. The crystal, 2 to 10 inches in diameter and several feet long, is sliced into thin wafers from which the chips are fabricated. Producing high-quality crystals requires precise control of the circulation and temperature within the crystal and melt, and the rate at which the crystal is pulled.

While a great deal of information has been collected on this process over the years, the systems are still designed and controlled largely on an empirical basis. In fact, despite their aura of sophistication, many high technology operations still defy precise scientific understanding. (In contrast, the physical chemistry of steel-making and the flow phenomena in the iron blast furnace have been studied for decades and are thoroughly understood.) In semiconductor production, for example, optimal process conditions are not always easily defined. The best results come when part of the melt is well stirred, to produce uniform composition, while the fluid near the melt-solid interface is kept quiescent, to avoid disrupting the fine structure of the final product. I recently patented a technique to achieve this by applying a rapidly fluctuating magnetic field in the bulk of the melt and a steady field near the crystal surface. A better fundamental understanding could well lead to more efficient production and higher-quality material.

A great deal of research both in the United States and

overseas is attempting to further intelligent processing of high-tech materials. Some most noteworthy U.S. work is being done at the National Institute of Science and Technology (NIST), in Gaithersburg, Md. In one effort, NIST is working on the production of fine metallic powders used in the manufacture of aircraft and automobile components such as landing gears, turbine disks, and engine superchargers. To produce this powder, high-velocity gas jets break a stream of molten metal into droplets, which solidify. Precise control of this interaction is critical to ensure the uniformly sized powder needed to produce finished components of superior quality.

In conventional processing, the solid powder product is periodically analyzed and the process is adjusted accordingly. But because of the time lag between analysis and corrective action, large quantities of unacceptable powder are often produced before the system is readjusted. In the NIST scheme, laser diffraction systems continuously analyze particle size as the powders are being produced. This analysis is combined with information from a model that relates the process conditions to the powder quality, enabling the system to adjust the pressure and velocity distribution in the gas jets "on the fly," yielding a uniformly sized powder.

Overcoming Barriers

Perhaps the greatest potential for intelligent processing lies in developing new process technologies. Today this is largely an intuitive process, especially if the innovation represents a radical departure rather than an evolutionary step. Mathematical modeling and knowledge-based processing can accelerate development and make it more cost effective.

Models can serve a kind of screening function—determining, for example, whether a proposed new process would conform to the basic laws of chemistry and physics. Some of these laws are

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obvious, such as the need to conserve matter and energy, but other constraints can be more subtle. It is important, for instance, to understand the rates of competing chemical reactions, to assess whether specimens can be heated or cooled rapidly enough to produce the desired outcome, and to determine whether a material's surface will remain stable. Mathematical modeling may minimize the need for experimental work on such factors. Models can also help design new processes or materials by establishing the ideal set of conditions—such as temperature, pressure, and patterns of fluid movement—for producing them. We may then build a system to meet these requirements.

Although the concepts underlying intelligent materials processing—the collation and use of all available information—may seem like engineering common sense, there are serious barriers to its wider use. The materials scientists engaged in product development are not usually comfortable with the engineering tools of sensing, control, and database development. The engineers who are expert at process control, conversely, tend not to be knowledgeable about materials science. The two approaches to modeling are also done by different groups of people. Mechanistic models emanate from basic-engineering laboratories; empirical models are built from the accumulated experience of thousands of factories, steel mills, and semiconductor fabrication facilities. While scientists are continually sharpening our fundamental and quantitative understanding of materials, this knowledge does not flow quickly from the laboratory to the shop floor.

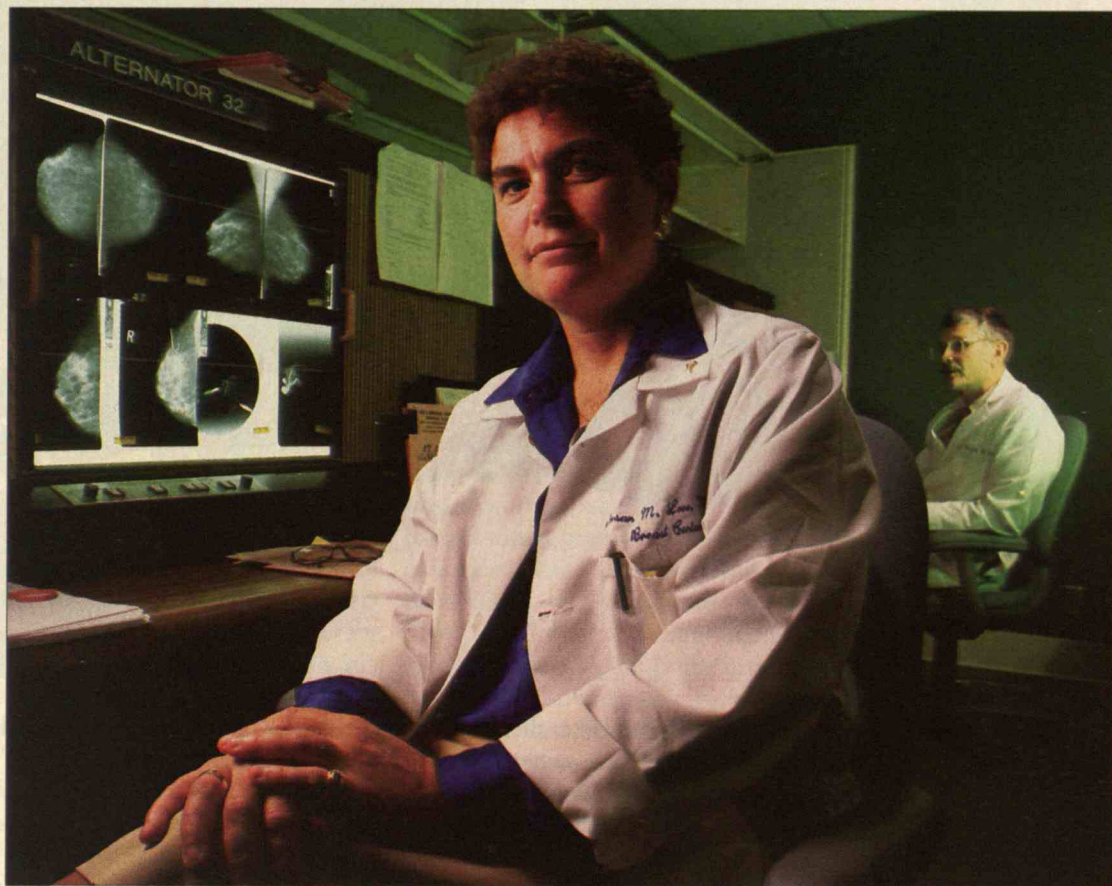
Thus, while the concept of intelligent processing originated in the United States, it is small wonder that the Japanese, who excel at forming interdisciplinary teams, are pushing the technology the hardest. We should follow their example and join them as master swordsmiths of the modern era. ■



A molten metal stream passes through gas jets, breaking into tiny droplets that cool rapidly to form a powder used to make aircraft and automotive components. A control system developed at the National Institute of Standards and Technology continuously monitors powder size, adjusting the gas jets to maintain uniformity.

Confronting Breast Cancer

AN INTERVIEW WITH SUSAN LOVE



When she started her medical career in 1980 as a general surgeon, Susan Love discovered that women were consistently coming to her with breast problems—and that it was because she was a woman herself. “I soon realized,” she has written, “that I could make a particular contribution in this area: I could combine my experience as a woman with my medical knowledge. I decided to specialize in breast problems.”

We can beat breast cancer, Love says—but only if we take a good, hard look at what's not working and put the lion's share of time, energy, and money into what is.



LOVE WANTS
BREAST SURGEONS
TO FORGE A PART-
NERSHIP WITH
THEIR PATIENTS—
WHICH MEANS
EXPLAINING MEDI-
CAL INFORMATION,
SHARING DECISIONS
ABOUT TREATMENT,
AND PROVIDING
EMOTIONAL
SUPPORT.

It was a decision that put her at the center of some of the hottest debates in health care. According to the National Cancer Institute, one in eight American women will develop breast cancer in her lifetime. While that oft-cited statistic can be misleading—for one thing, it assumes a lifetime of 95 years—the facts about breast cancer are nevertheless grave. In the next year alone, 180,000 women in this country will hear the dreaded diagnosis, and another 46,000 will die of the disease.

No one is more concerned about the situation than Love, now probably the most famous breast cancer authority around, with a reputation for warmth toward her patients and sarcasm toward those who take the disease lightly. In 1988 she founded Boston's Faulkner Breast Center, a small, private clinic that has earned national acclaim for its excellent care. In 1990 she published the popular *Dr. Susan Love's Breast Book*, a comprehensive and accessible guide that *Ms.* calls "one of the most important books in women's health in the last decade." The *Journal of the American Medical Association* also approves, observing that "like a good teacher, Dr. Love

is able to impart the vast knowledge she has in the language of her audience." Love has been a mover and shaker on the political scene as well, most impressively as a founding member of the Breast Cancer Coalition. In the two short years of its existence, that national grassroots lobbying organization has helped raise the breast cancer research budget from \$90 million to over \$400 million.

Last year Love became the founding director of the UCLA Breast Center, which aims to be the world's leading breast treatment facility. It will boast the latest procedures, an extensive research agenda, psychological services, instruction for medical students, seminars for outside doctors, and special clinics for a wide range of breast conditions.

But what drives Love in all this is more than a sense of urgency—she also has profound hope, believing that given adequate funds and intelligent research priorities, the fight against breast cancer can be won, and soon. "It pleases me to think that my daughter won't be able to follow in my footsteps, because there won't be enough breast cancer for her to treat," she has said. In the meantime, she's

determined to get doctors to treat their breast cancer patients as humanely as possible. And she maintains that they won't be able to do so unless they develop listening and empathy skills not ordinarily taught in medical school.

Such conviction has made her one of the busiest people anyone could hope to meet. When she agreed to talk with *Technology Review* associate editor Beth Horning, she suggested a coast-to-coast telephone interview—at 4:00 a.m. California time.

TR: One of the most frustrating problems women face as they try to protect themselves against breast cancer is that the rules keep changing. For instance, we've long been told that women in their 40s should get a mammogram every year or two, but in February, when the National Cancer Institute convened a meeting of mammography experts, they generally agreed that this is not necessary. What's going on?

LOVE: The basic problem is that no one quite understands the disease yet. We're just beginning to fill in the gaps in our knowledge, and as we do, doctors naturally find themselves reevaluating some of their recommendations.

In the case of mammography, there have never been any data that really support it in younger women. All the studies showing how great it is have been on women over 50. What happened was that early on, when the American Cancer Society and others came up with the mammography guidelines, they did the best job they could with the limited information they had, and now data are coming in that suggest they were wrong on some points. For example, the Canadian National Breast Screening Study, which was published this past fall, found that women between the ages of 40 and 49 have about the same death rate from breast cancer whether or not they have routine screening mammograms. So as a general rule, mammography screening for women in that age group is not worth it.

You know, I think we doctors have to be careful sometimes of taking ourselves too seriously. Those guidelines for mammography came out and we just kept repeating them. We did it for such a long time that we started to believe they reflected the absolute truth—we forgot that our understanding of how to fight breast cancer is still evolving.

TR: Yet even now some doctors and health organizations promote regular mammograms for women in their 40s. Is it reasonable to sus-

pect a profit motive? After all, there are a lot of women in their 40s, and if they all get mammograms every year, it's going to add up to a substantial amount of business.

LOVE: I don't really see that as the issue. First of all, when we say mammography isn't worth it for women in their 40s, we mean in a public policy sense. That is, if we're going to fund mammography for large populations of women, what's cost effective? But for some individual women in their 40s, routine mammograms might actually be a good idea. I'd say a woman should get a baseline mammogram done around 40 or 41 and see if her breast tissue is not so dense as to make it hard to interpret. If it's not, then she might consider going ahead and getting a routine mammogram every year or year and a half, especially if she has risk factors, such as a first pregnancy after 35 or a family history of breast cancer. I myself fall into that category—I'm 45 and I get a mammogram every year.

All that aside, though, I agree that unnecessary mammograms are being done, and I think the reason is mainly that the doctors who order them are not always educated. That's particularly true of primary care doctors. There's this idea that if mammography is good in women over 50, it must be better in women in their 40s, and maybe even better still in women in their 30s. And then in a few exceptional situations it does seem reasonable to suspect a profit motive. Mammography centers in some places will do a mammogram on anyone who comes in.

But there's another problem: younger women often demand mammograms. And I believe a lot of that is the media's fault. Every time you see an article about breast cancer, it shows a young woman. It shows a 20-year-old in the shower feeling her breast, not a 60-year-old. The truth of the matter is that breast cancer becomes more common the older you are, but you'd never know it from the way the disease is depicted.

TR: Some critics of the media go even further. They say that the main effect of all the recent publicity on breast cancer has been to stir up needless panic among women.

LOVE: I disagree. Breast cancer does send incredible fear through women's hearts, but I don't think that's because it's had too much publicity. I don't even think it's entirely because breast cancer can be fatal.

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The patient should
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Probably women fear breast cancer for a combination of reasons, and one of them has to be that the treatment might entail a mastectomy, which is understandably perceived as a kind of mutilation. The breast has some special psychological baggage—for one thing, there are all the associations of breastfeeding and nurturing the next generation. Then, too, the breast is the most obvious identifying feature of femaleness. Think about it: if some androgynous-looking person comes walking down the street, the first thing you do to try to figure out if they're male or female is to look at their chest.

Gut Feelings, Medical Facts

TR: What about those women for whom the fear of breast cancer becomes a reality? How do you help them work through these complicated, difficult emotions and get on with the business of fighting the disease?

LOVE: The first message I try to get across is that a diagnosis of breast cancer is not an emergency. The typical notion is that you're a time bomb and the cancer is going to take over your body unless you do something tomorrow. Well, that's just not true. By the time they're diagnosed, most breast cancers have been around for years, which means it's unlikely that anything too dramatic will happen right away. You really do have a few weeks to research the subject, get second opinions, sort out your feelings, and so on. I also think it's vital to treat women like intelligent human beings who are capable of doing all that.

So the doctor needs to give the patient a lot of information and spend the time that's needed to explain things. Whatever decision is made about treatment should be shared. But unfortunately, the medical profession hasn't done a good job of preparing doctors to work that way—we were all taught to say "If I were you, I'd do such and such," or "If you were my wife, I'd want you to do such and such," which is problematic, because the patient is not us, and she's not our wife, either. Often the result is that the values of a white, middle-aged man are imposed on a patient who is female and maybe older or younger, maybe white and maybe not.

TR: Even so, it could be argued that with regard to cancer, people's values are somewhat universal—everyone tends to want to live as long as possible, within certain limits. And no

matter how intelligent a patient is, she probably won't be as adept at weighing medical facts as a doctor.

LOVE: But it's often unclear to everyone, even the doctor, what will make the patient live longer. Also, gut feeling and upbringing and plain personal preference play a bigger role than medical facts in many of the decisions women have to make.

TR: Decisions like what?

LOVE: Like whether to get a mastectomy or a lumpectomy—an operation that removes just the cancerous part of the breast plus a small rim of normal tissue and is followed by radiation. That's not the momentous sort of choice people often imagine it is: in most cases, either of those treatments will work as well as the other, so really you're deciding between two routes to the same goal. A woman who's determined to keep her breast is usually willing to put up with the six-week energy drain of radiation treatments, while a woman who isn't so determined and who has an especially demanding schedule, like former First Lady Nancy Reagan, might well choose mastectomy.

Or a woman may be concerned that radiation could present long-term risks. For example, some of my younger patients have pointed out that we don't know what effects radiation has over a 40-year period. They'd rather face a mastectomy now than a new, radiation-associated cancer in their old age.

TR: That said, it seems most women would prefer to keep their breast if they don't have to risk dying of breast cancer to do so. Yet mastectomies are widespread. Why?

LOVE: In many parts of the country radiation treatments aren't available, or if they are, they aren't very good. But another problem is that most surgeons are more comfortable performing a mastectomy than a lumpectomy, and since the two treatments are equivalent in their success at saving lives, of course they're inclined to recommend the one they're more comfortable with.

And some of them recommend it before the shock of the diagnosis has worn off, which means that the patient is unlikely to question them or ask for a second opinion. What often happens when people get a diagnosis of cancer is that they panic and regress to the level

of a kid for a day or two. They want the mommy or daddy to tell them what to do and just make it go away. Well, if at that moment someone is standing there who says, "OK, I'll take care of you and I'll cut your breast off and everything will be fine," then they'll go along with it.

At the same time they might fool themselves about what their real feelings are. Sometimes they'll think of the mastectomy as a way to punish their breast for betraying them. Or they'll think, "It's vain of me to want to keep my breast," and "I'm more than just a breast," and on and on. But wanting to keep your breast is not about vanity. It's about being intact as a person.

Even when a patient has got over the shock of diagnosis, doctors can make it hard for her to come to a good, clear-headed decision about what kind of surgery she wants. They'll say things like "Well, you're elderly and you're widowed—you don't need your breast anymore. Why don't you just have a mastectomy? It'll be easier." In my experience, though, older women aren't any more likely than younger ones to want a mastectomy.

TR: But why are surgeons so much less comfortable with lumpectomy in the first place?

LOVE: To do a good lumpectomy is simply more difficult. On top of that, most breast surgeons have never been trained in it, because it's a relatively new operation and they went to medical school in the days when everyone just did mastectomies.

A few of my colleagues and I are collaborating on a breast surgery atlas that we hope will remedy that situation—it should not only help teach other doctors how to do lumpectomies but how to do them with an eye to what the breast will look like afterward. After all, surgeons need to think about their patients' lives. And some of the considerations are pretty simple. For example, most surgeons operate with the patient lying down, and if they're not careful, the breast ends up looking



BREAST CANCER CELLS GROWN IN VITRO COULD HELP RESEARCHERS UNDERSTAND THE DISEASE AT THE MOLECULAR LEVEL. ACCORDING TO LOVE, THIS KIND OF WORK IS MORE PROMISING THAN CONVENTIONAL STUDIES ON SURGERY, RADIATION, AND CHEMOTHERAPY.

good only when the patient is in that position. Yet what usually matters most to women is how their breast looks when they're standing or sitting.

New Priorities for Research

TR: Another aspect of care you've often advocated is breast cancer support groups. Why are they so important?

LOVE: Well, cancer, including breast cancer, is a lonely problem. At first your family rallies around and is very attentive, but that doesn't always last—whereas the disease of course does. Even the women who are cured won't know that until several years later. And having people to talk to who have been through the same thing is vital. It helps you learn how to deal with this crisis and get on with your life.

Actually, it might even contribute to your longevity. A study by David Spiegel, a psychiatrist at Stanford Medical Center, showed that if women whose breast cancer has invaded other parts of the body participated in support groups, they lived an average of 18 months longer. One of the studies we're doing here at UCLA will try to find out what the effects are in women who are newly diagnosed

Genes seem to be at the root of all breast cancer, and we're on the verge of some important discoveries about how they work.

and whose cancer is at an earlier stage. There's no question that there's a mind-body connection, and one of the things that may help boost the immune system is getting social and psychological support of some kind.

TR: How about other measures to help patients live longer? It's been reported that researchers are learning more and more about how to make the most effective use of surgery, radiation, and chemotherapy.

LOVE: Maybe they are, but our progress in adding years to women's lives with these kinds of treatments has not been impressive. For example, in certain subgroups of women whose disease is not too advanced, supplementing the usual mastectomy or lumpectomy-plus-radiation with chemotherapy does improve survival—but only by about 8 or 10 percent. Those are not huge numbers.

It's clear that surgery, radiation, and chemotherapy—"slash, burn, and poison," as I've been known to call them—are rather crude ways of dealing with the problem. Even so, the research establishment continues to spend enormous sums of money on them, asking tired, old questions like "Should we give chemotherapy for three months or four months?" and "Should we give patients four drugs or five drugs?" What we need to do instead is put more of our funds into figuring out how the disease progresses at the molecular level, because that's where the real answers are going to be.

TR: What makes you so sure?

LOVE: Cancer research shows that genes play a highly significant role. Sometimes the problem is an inherited gene, but there's evidence that even when it isn't, genes are involved in some way. For instance, researchers have found that each of the viruses linked to cancer in animals has a specific gene responsible for initiating the abnormal cell growth and sustaining it. We suspect that something like this goes on in humans as well. Not that an invading virus would always be the culprit—another factor, such as diet, could cause certain genes already present in the body to change in such a way as to promote cancer.

With regard to breast cancer, we're starting to make some real advances in understanding these sorts of things. We're on the verge of identifying the gene that causes hereditary breast cancer—it'll probably be announced in the next

month or two. Now, only 5 percent of breast cancer is hereditary and thus caused by this particular gene, so it's not as if the discovery will change everyone's life. But since genes seem to be at the root of all breast cancer, identifying one of them is an important first step. Eventually we might learn enough about genes and how they function to devise some form of extremely early breast cancer detection—maybe a blood test that could tell us when the relevant genes have gone awry. You know, women are always being told about the importance of early detection, but in the current state of the art, we can detect breast cancer only at a relatively late stage. The cancer has typically been there for 6 years if it shows up on a mammogram and 8 to 10 years if you can feel a lump.

TR: How much good would this blood test do? You'd know that the patient had breast cancer, but since you wouldn't know where the tumor was, it would be difficult to treat.

LOVE: Not necessarily. Part of the research that would produce the blood test might also lead to new ways to combat the disease. For example, if we know which gene has changed, and if we know what has made that happen, we've already laid the groundwork for some form of gene therapy that could correct the problem. Also, since we would be finding the cancer so much earlier, treatment probably wouldn't have to be as rugged as it is today.

TR: Early detection and treatment certainly would be good, but it would be better if we could go a bit further and actually prevent breast cancer. What do you see happening on that front?

LOVE: That's another important area where we need more research. Of course, understanding the molecular workings of the disease could help greatly, since it might yield ideas for ways to keep those workings from ever being set in motion. But we also need to go outside the lab and conduct studies on populations of women to see if possible prevention strategies are effective. And that presents a problem: you never know anything until the women in the test group start to be diagnosed with breast cancer, which can take a long time.

Now, it would help a lot if we had a good way to tell when the cells are going through the early changes that typically precede breast cancer. We do have such techniques for other kinds of cancer. For instance, you can tell from

a pap smear whether a woman might be ready to develop cervical cancer. But you can't tell whether she might be ready to develop breast cancer unless maybe you perform a biopsy, which usually means taking out a chunk of her breast. That's something no one's going to want to do every year.

One way we might address this difficulty is through something called duct endoscopy. If you look at a cross section of the breast, you'll see that the tissue is full of tiny hollow tubes that extend from the nipple and branch off into grape-like clusters. These tubes are called ducts, and there's a little scope that's been used in Japan to look into them. But so far, it's been used only on women who have nipple discharge. I want to find out if it could also be used on women whose breasts seem normal—if it can, we might be able to detect suspicious early cell changes in the duct lining and take action.

TR: Are any worthwhile prevention studies being funded now?

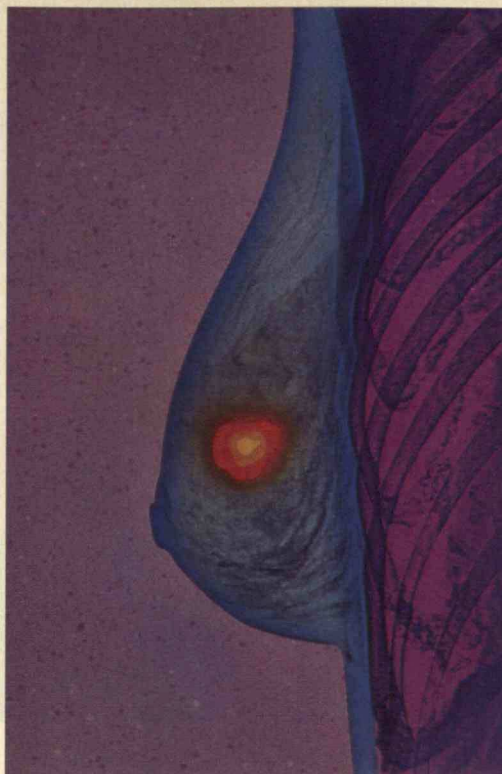
LOVE: Yes. Last spring the National Cancer Institute began its first prevention study. It's on tamoxifen, which has been used with some success to treat women who already have breast cancer. That treatment has reduced the rate of cancer in the second breast by 30 percent. In the study, healthy women who have risk factors will be taking the drug, to see if it might reduce the rate of initial cancer as well.

Tracking Down Carcinogens

TR: Not everyone is happy about the tamoxifen trial. Critics point out that the drug carries risks of its own, including eye damage, liver failure, and cancer of the uterine lining.

LOVE: Well, the best way to weigh those risks against the risk of breast cancer is to conduct a good, controlled trial, and that's what we've got. This is one of the few cases where legitimate questions about a drug prescribed to women are being addressed in a legitimate study.

The usual state of affairs is that we do these huge experiments without even acknowledging them as experiments. Take DES. Thirty or forty years ago doctors routinely prescribed it to women to prevent miscarriage, and later on, when it turned out that the daughters born to these women had a particularly high incidence of vaginal and cervical cancer, the medical establishment said, "Whoops! Guess that wasn't such a good idea."



THIS COLOR-ENHANCED MAMMOGRAM REVEALS A TUMOR. MAMMOGRAMS ARE RECOMMENDED FOR EARLY DETECTION, YET THE BREAST CANCER THEY REVEAL HAS TYPICALLY EXISTED FOR SIX YEARS. RESEARCH COULD YIELD BLOOD TESTS ABLE TO DETECT THE DISEASE AS SOON AS A WOMAN'S GENES HAVE UNDERGONE TELLTALE ALTERATIONS.

Or to bring this into the present day, let's consider fertility drugs. There's a chance that they could increase ovarian cancer or breast cancer, but nobody's looking into it. Doctors are just passing them out like M&Ms. And take hormones for post-menopausal women. We don't know enough about that medication. There's evidence that estrogen alone will prevent heart disease and osteoporosis and increase uterine and breast cancer. Adding progesterone, which is the popular thing right now, appears to block the good effects on the heart but protect the uterus, while still preventing osteoporosis. But what effect will the combination of estrogen and progesterone have on the breast? Gynecologists have been saying, "Well, if it protects the uterus, it'll protect the breast." Unfortunately, however, that's an assumption you can't make. The breast is not the uterus.

Now, the good news here is that we have a relatively young woman, Bernadine Healy, heading up the National Institutes of Health, and she wants to get some of these questions answered before she hits menopause herself. She has set up the Women's Health Initiative, which is a 14-year study of diseases in women as they age, so that post-menopausal hormones have finally become a subject of serious scientific inquiry.

But getting back to the tamoxifen trial, I have to say that even though I support it, I hope we

The breast cancer epidemic will continue unless women lobby hard for more research and better care.



don't stop there. Women are already being given drugs right and left, and it bothers me that we're adding another one to the pile. I would rather see studies that would lead to other approaches to prevention—for instance, studies on what some of the carcinogens might be.

TR: Do you think some of those carcinogens might be environmental?

LOVE: It's a possibility. For example, Frank Y. Falck, a toxicologist at the University of Connecticut, has come out with some very preliminary data showing that women with breast cancer have higher levels of pesticides in their breast tissue.

And there are also some important unanswered questions about the toxins that tend to be concentrated in dietary fat. Walter Willet of Brigham and Women's Hospital in Boston has published a well-respected study suggesting that a moderately low-fat diet will not protect adult women from breast cancer, but maybe what really matters is the fat women eat during adolescence, when breast tissue is still being formed. If that turns out to be the case, the issue of toxins in the fat is certainly worth considering. After all, our grandparents, whose world contained fewer toxins, ate more fat than we do, and yet breast cancer is more common now.

Grassroots organizations are suggesting topics for research, too. For example, women in Nassau County on New York's Long Island

have a rate of breast cancer that's significantly higher than average, and the Long Island Breast Cancer Coalition will be holding hearings on some of the possible environmental causes. I'm going to be heading the panel in charge of the hearings, along with Devra Lee Davis of the National Academy of Sciences.

TR: But didn't the Centers for Disease Control already do a study of causes in that cluster of cases? And didn't it find that the increased incidence could be explained through known risk factors?

LOVE: The CDC didn't really do a study. They just formed a panel that examined the existing data, which include nothing about the environment. Granted, it could be that the panel came to the right conclusion anyway, that the environment has nothing to do with this cluster of breast cancer. But I think it's short-sighted to dismiss the matter out of hand. So we're going to be looking at a variety of issues, such as pesticides and toxic-waste dumping, as well as some of the hormones that are fed to cattle and chickens and then get passed along to us through our diet.

You know, you have to be careful when you talk about risk factors, because we don't even know what all of them are. We've been able to isolate a few, but they're not very predictive. We can't say "You women here in this group are at high risk and you over there in that other group are home free." Some 70 percent of the

women who develop breast cancer have no risk factors at all.

TR: Some female doctors have concluded that there needs to be a new medical specialty devoted to women's health, and a lot of what you've said would seem to support that. It sounds as if you're suggesting that breast cancer doesn't always get the right kind of attention in the medical establishment as it exists now.

LOVE: My general feeling is that a new specialty is not a good idea. The only way I could see it would be as an area of research. It could be like geriatrics—there's a whole class of studies done in that area, but when old people get sick, they go to an internist or a general practitioner, not a geriatrician.

The danger is that we'll make women's health even more ghettoized than it already is. What we should be doing instead is transforming the way the medical establishment as a whole relates to women. And I think that's possible. Most doctors want to do the right thing. Their difficulty is not really misogyny but a lack of education. In fact, I'm so convinced of this that it's one of the main reasons I left the Faulkner Breast Center in Boston to come to UCLA, where I've been doing a lot of work with medical students and residents.

You see, the Faulkner Breast Center was something that evolved out of my private practice and became a very woman-oriented place. By the time I left we had five breast surgeons, a plastic surgeon, two radiation therapists, and two oncologists—all of whom were women. We were doing work that I was proud of, taking good care of women both medically and emotionally. But I came to the conclusion that if we can do that only in an all-female setting in an isolated private practice, then we're in trouble. Women doctors need to bring their perspective into the medical mainstream.

TR: And you think that will be enough to stop the spread of breast cancer?

LOVE: No. Women, whether they're doctors or not, also need to take to the streets and yell and scream. That's something we've learned from the AIDS movement: nothing gets done unless you make a loud noise. Women are angry that the breast cancer epidemic continues without much change, and it's crucial to focus that anger and put it to good use. Our lives depend on it. We can't let this disease pass on to another generation of women. ■

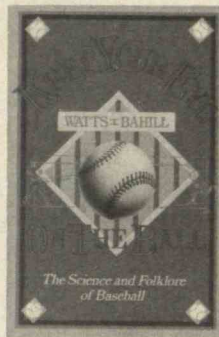
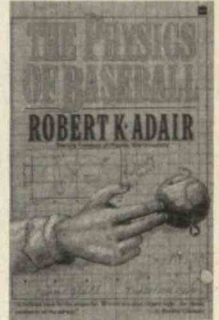


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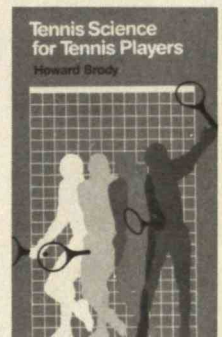
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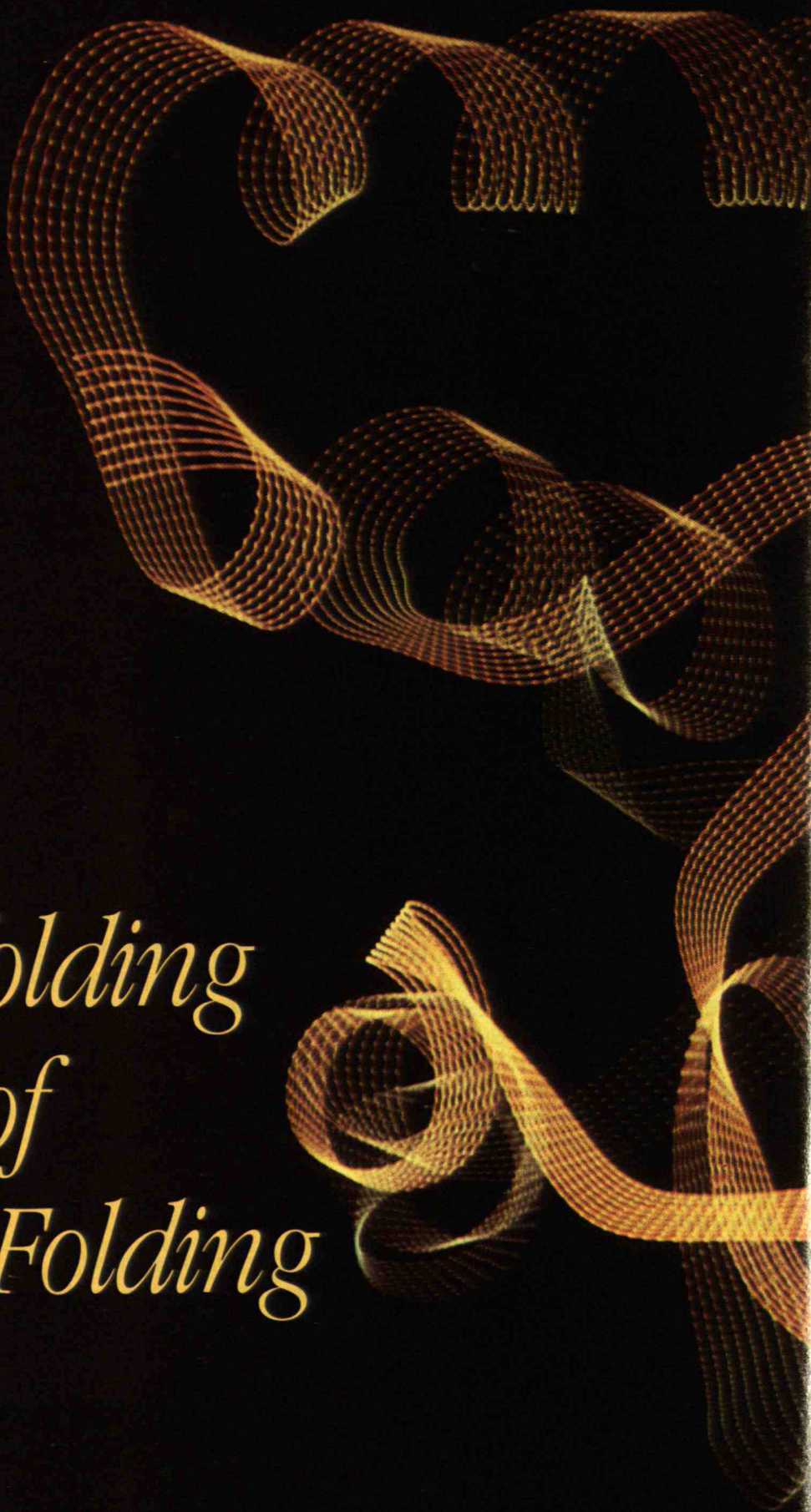
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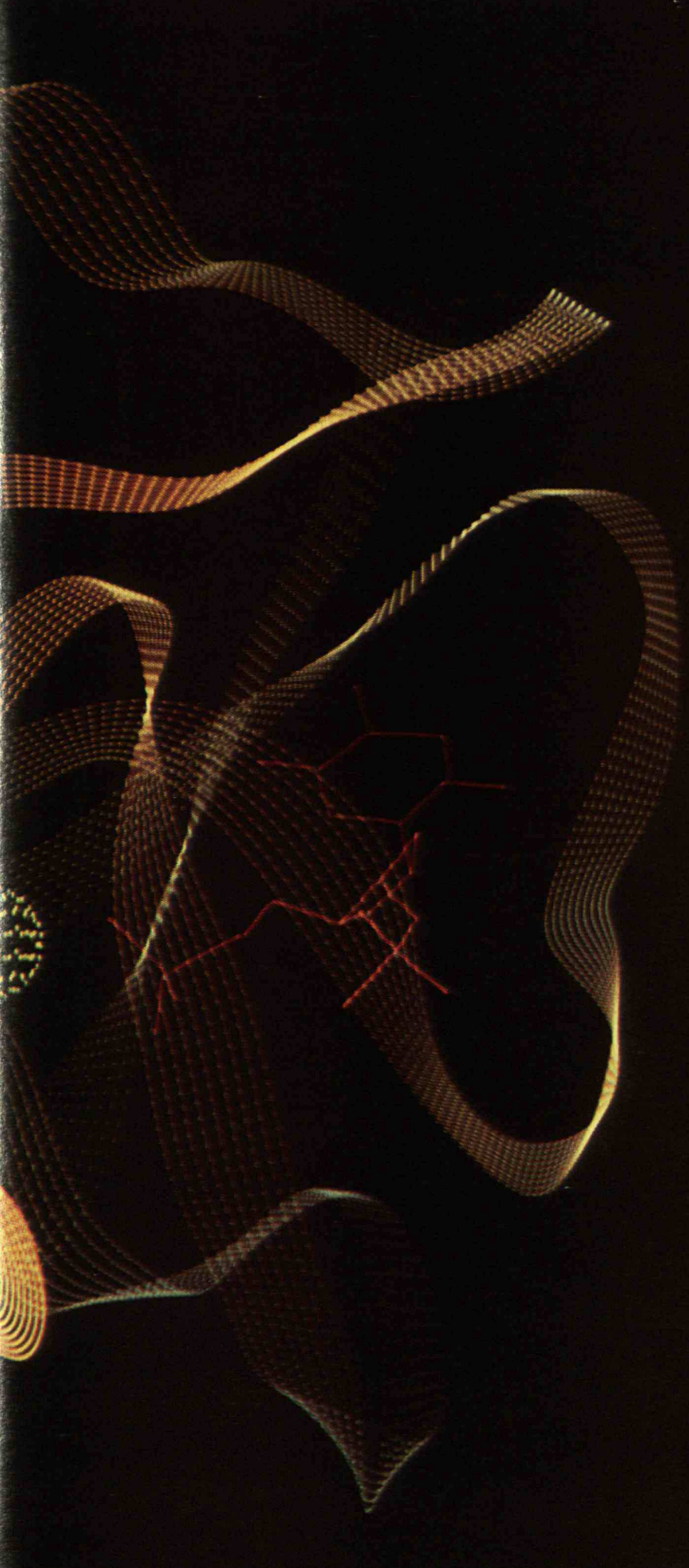
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The Unfolding Puzzle of Protein Folding

BY JONATHAN KING





WITH the hunt in full swing to identify all of the 100,000 or so human genes, it's easy to forget the underlying reason for this ambitious quest. Most genes serve as blueprints for the formation of proteins. If the genes do not correctly direct protein manufacture, a person's development and health are threatened.

In many cases the problem reflects how a protein chain folds. The three-dimensional shape that a protein forms provides it with unique biochemical powers. For example, the molecules composing the protein collagen, required for the formation of bones, tendons, and ligaments, have a rope-like structure and coil around each other to form thick cables. A single genetic error can prevent

proper collagen folding and result in a malformed skeleton—a common birth defect.

The biotechnology industry has encountered unexpected bottlenecks because of the failure of protein chains to fold correctly. When Eli Lilly first tried to produce the human protein insulin for diabetics, for instance, the result was biologically inactive material that resembled scrambled eggs. Although the production team was able to splice the human gene for insulin into DNA molecules of bacteria and get them to synthesize the needed protein chain, it folded incorrectly in the foreign environment. Using the time-consuming and expensive process of trial and error, Eli Lilly finally unfolded the scrambled-egg material and correctly refolded it.

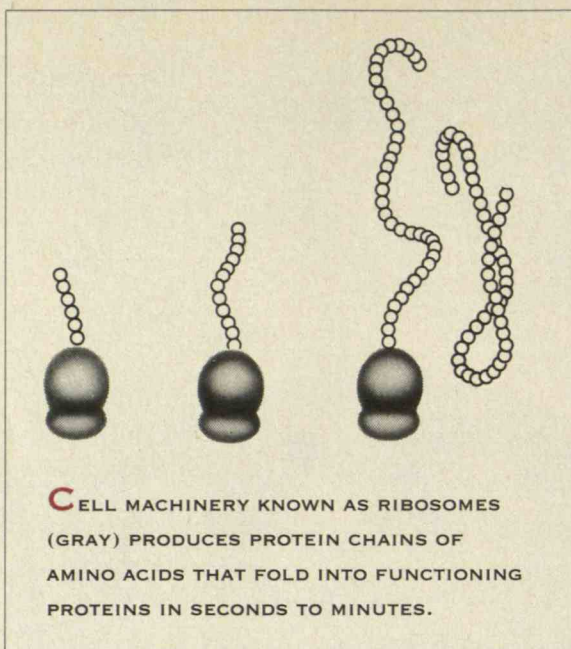
That protein chains fold into particular structures was first established 35 years ago, when John Kendrew and Max Perutz, then at the British Medical Research Council, used x-ray diffraction to reveal the three-dimensional shapes of the blood proteins hemoglobin and myoglobin. Since then scientists have established that more than 500 proteins each routinely fold into single conformations out of hundreds of millions of possibilities.

Biochemists, geneticists, and computer scientists have yet to decipher the general rules for how proteins fold after they are synthesized by ribosomes, the cell machinery that manufactures them. But today the signs look good: the growing interest in identifying human genes and the advancing state of the biochemists' art, coupled with significant improvements in chemical instrumentation and computational power, are enabling rapid progress in the field. Once the protein-folding problem is solved, major advances in human health and pharmaceutical production, as well as the development of entirely new proteins and materials, should follow.

Grand Designs for Pearl Necklaces

A protein can be thought of as a folded string of pearls left in a jewelry box. The "pearls" are amino acids. The 20 kinds of amino acids used in living organisms are strung together in various orders and lengths through common "peptide" bonds. Biologists know the sequence of amino acids for thousands of proteins. The collagen found in tendons, for example, has 1,053 amino acids along a peptide chain.

JONATHAN KING, a professor of molecular biology at MIT, co-edited Protein Folding (American Association for the Advancement of Science: 1990) and is a member of the governing council of the Biophysical Society.



The sequence of the amino acids in any protein—which is determined by one or more genes—regulates the folding of the protein chain. (If a gene is damaged, the amino acids' order changes, usually causing a problem.) The underlying mechanism for the folding appears to lie in the interactions among the amino acids' side chains. Each amino acid has a chemically unique side chain (with one exception: glycine lacks such a chain).

The first breakthrough in understanding how a chain of amino acids could be packed into a regular structure was made by the chemist Linus Pauling in the early 1950s. Pauling predicted, based on his determination of

crystallized amino-acid structures, that many proteins should include folds of two basic arrangements. He called these alpha helices and beta sheets. The prediction has proven accurate.

Almost any sequence of amino acids can be folded into an alpha helix, which consists of a chain that coils in a right-handed manner with 3.6 amino acids per turn. An alpha helix is reinforced with struts made of hydrogen bonds running up and down the helix's surface. Alpha helices frequently pack against one another within a folded protein. This is the case, for instance, in the blood protein hemoglobin, where packages of seven helices form pockets for binding oxygen. This structure transports the oxygen from the lungs to the rest of the body's cells.

In beta sheets—which give silk its special properties and are the major structure found in antibodies—rows of protein chains lie parallel to each other, with a network of hydrogen bonds among the chains. Beta sheets can either lie flat or curve into barrel shapes. Many enzymes—proteins that catalyze biochemical reactions—use the barrel structure. The barrel provides rigidity for correctly positioning the molecules undergoing a reaction.

Although crystallographers and biologists are rapidly determining the precise combinations of alpha helices and beta sheets—along with connecting turns, loops, and random coils—in various proteins, figuring out exactly how protein chains change from their initial linear sequences into their final forms has been far more challenging than originally imagined.

One problem has stemmed from the difficulty of understanding the thousands of very weak chemical interactions that occur as the protein chains fold. Many research laboratories are trying to measure the forces involved in these interactions, and there is great debate over the exact formulas.

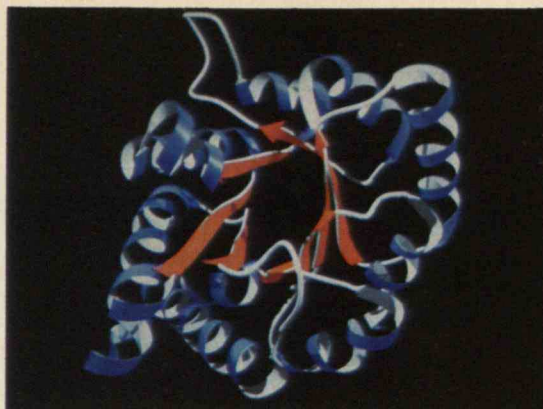
Scientists also do not yet fully understand the chemical role played by water. They do know, however, that a key

step in the folding of a protein chain occurs when the side chains form the protein's core while water is excluded from inside the core.

Another difficulty has been that for virtually all proteins, only a fraction of the amino-acid sequence encodes the folding process. To determine which amino acids play a role, scientists generate amino-acid changes in proteins. Using this process, my research group has identified altered protein chains that fail to fold properly and certain positions in those that are essential for the folding reactions.

Another problem with figuring out protein-folding rules arises from the fact that the protein chain does not pass directly from an unfolded to a fully folded, or native, state. Temporary states, known as folding intermediates, appear along the way. Think of the simple arch. Why it holds up once it is completed is clear, but to understand its construction an observer must be there when it is being built. Partially built arches are unstable and require scaffolding and other arrangements to keep stones in the right position before the capstone is in place.

Solving the protein-folding problem requires identifying



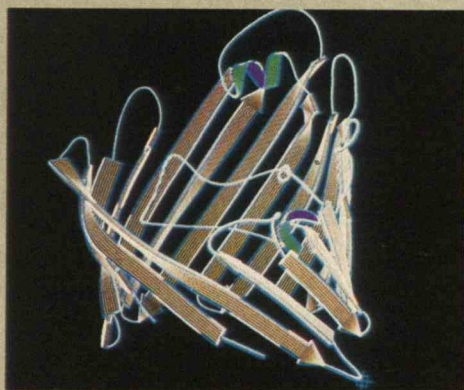
AS THEY FOLD, PROTEIN CHAINS OFTEN FORM HELICES SUCH AS THOSE ON THE OUTSIDE OF THIS BARREL-SHAPED STRUCTURE—AN ENZYME CALLED TRIOSE PHOSPHATE ISOMERASE THAT HELPS METABOLIZE SUGAR MOLECULES IN CELLS.

and describing the shapes of intermediate states, which last only milliseconds to minutes and are very difficult to observe with traditional spectroscopic methods, which interpret the structure of molecules based on how they absorb light. In 1988, developments in nuclear magnetic resonance (NMR) spectroscopy—a process that allows one to measure the spatial proximity of atoms in protein chains—enabled protein chemists Heinrich Roder, Walter Englander, and Gulnar Elove (all then at the University of Pennsylvania) to determine intermediate folding structures for cytochrome c, a protein found in the respiratory system. The researchers discovered

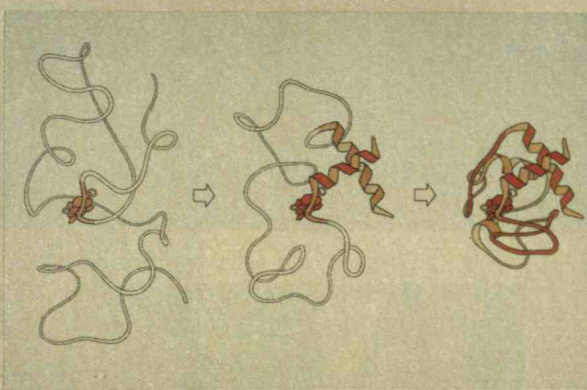
that, surprisingly, the ends of the cytochrome c chain form helices and dock against each other before the amino acids in the middle of the chain form a third helix.

Thomas Creighton, a protein biochemist at the British Medical Research Council, has examined folding intermediates of the protein BPTI (bovine pancreatic trypsin inhibitor, a cousin of a human lung protein whose damage contributes to emphysema). The final structure of this protein

Continued on page 61



LEFT: MANY PROTEINS ALSO CONTAIN BETA SHEETS, ROWS OF PARALLEL PROTEIN CHAINS. HERE A SET OF BETA SHEETS FORMS THE WALLS OF A CYLINDRICAL STRUCTURE IN THE PROTEIN PORIN, WHICH TUNNELS INTO THE OUTER MEMBRANE OF BACTERIA, ALLOWING



THE ENTRY OF SUGARS AND OTHER SMALL MOLECULES. RIGHT: DURING FOLDING, PROTEIN CHAINS UNDERGO SHORT-LIVED INTERMEDIATE STATES OBSERVED ONLY RECENTLY. AT THE UNIVERSITY OF PENNSYLVANIA, CHEMISTS HEINRICH RÖDER, WALTER ENGLANDER,

AND GÜLNAR ELOVE DISCOVERED FOLDING INTERMEDIATES FOR THE RESPIRATORY PROTEIN CYTOCHROME C. THE CHAIN'S ENDS FORM HELICES THAT DOCK TOGETHER BEFORE THE MIDDLE PART FORMS THE THIRD HELIX OF THE FINAL STRUCTURE.

A Gallery of Protein Images



B



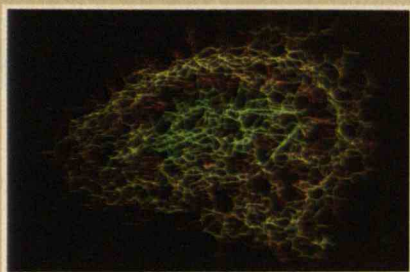
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B I O L O G I S T S

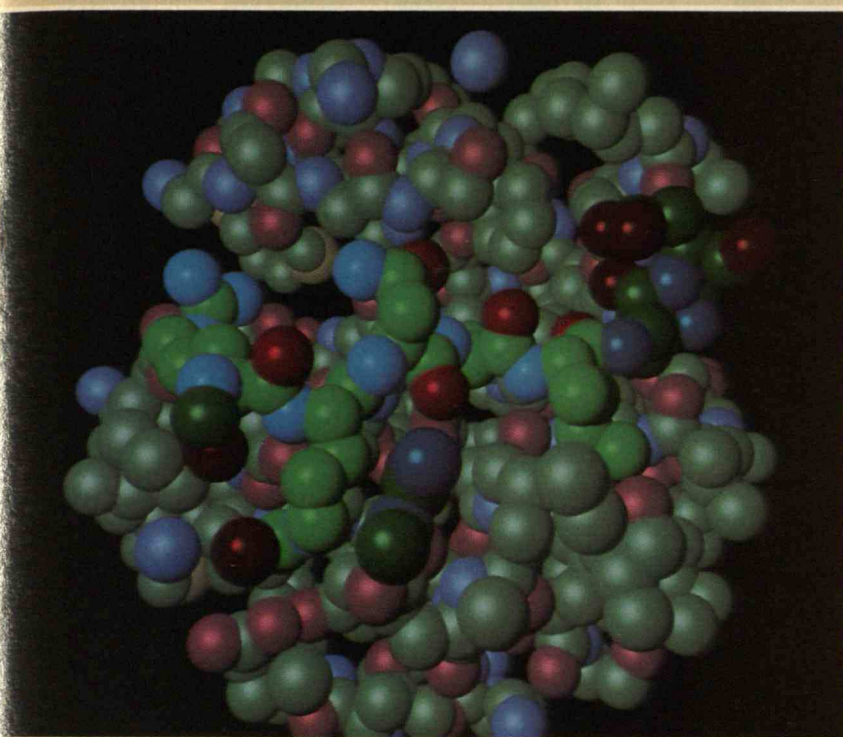
use a variety of visual techniques to show the intricate relationships among the molecules that make up folded proteins and determine their functions.

A protein—for example, the bovine pancreatic trypsin inhibitor shown in figure A—can simply be considered a string of amino acids, abbreviated by initials. But indicating how a protein's “backbone” of peptide bonds folds—shown as the ribbon-like structure—and the amino acids' side chains branch out reveals much more information. Jane S. Richardson and David C. Richardson, professors of biochemistry at Duke University, have drawn an analogy to origami (B, C), calling both folding processes “subtle and mysterious.”

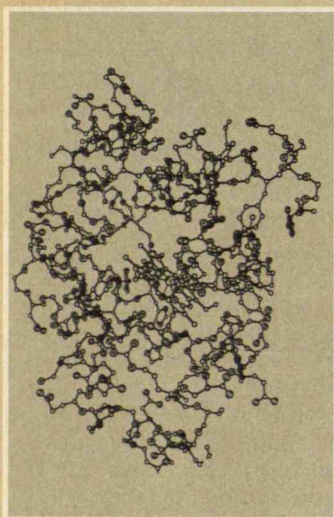
Many images of folded proteins concentrate on detail. “Sticks” are often used to represent individual atoms, such as in figure D, which shows all of the atoms (except hydrogen) in bacteriochlorophyll. Spheres are also employed for the same purpose. Figure E shows part of a protein kinase enzyme. (The bright spheres represent a protein fragment bound to the enzyme.) A combination of balls, representing atoms, and sticks, showing the bonds between them, can depict plenty of detail, too (F). Computerizing such images allows researchers to color certain sections or zoom in to examine small features such as the loop in figure G, which is found in many pro-



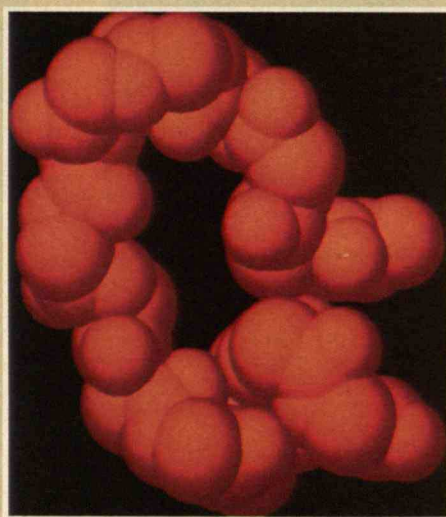
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E



F



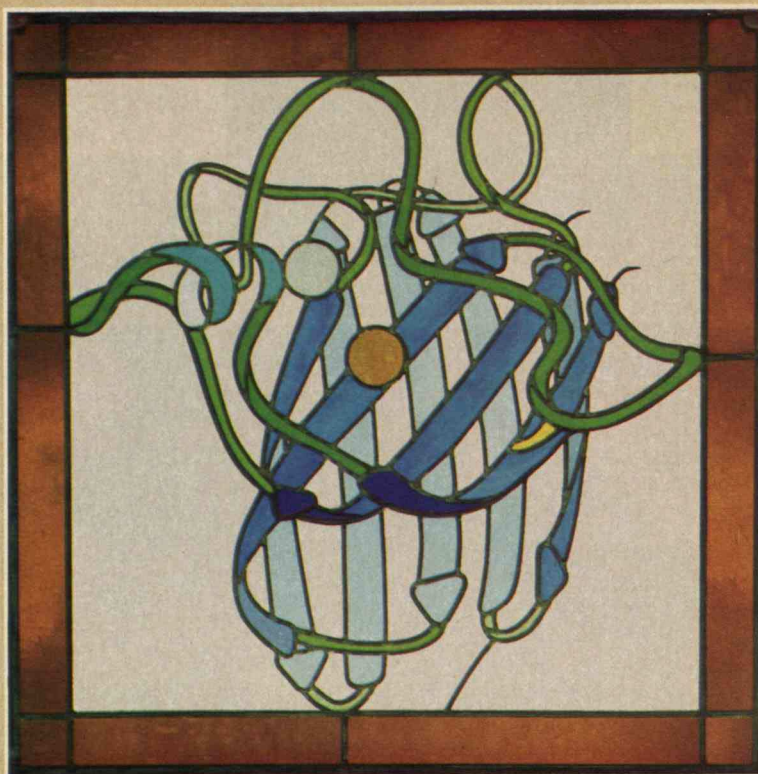
G

teins. Without such an ability, these images are best used to reveal proteins' overall size, shape, and complexity, Richardson says.

Attempts at simplifying the images have led to various kinds of ribbon-shaped representations. For example, Richardson commissioned a stained-glass artist to depict part of the protein superoxide dismutase. Arrows are used to distinguish flat strands from other sections such as a helix (H). In Figure I, cylinders represent helices in a protein named Felix designed by the Richardsons to test assumptions about how proteins fold. Thomas Macke, a graduate student in molecular biology at The Scripps Research Institute, says that "tubes," which can show the shape of the peptide backbone of proteins, also effectively represent three-dimensional space. Figure J compares the backbones for the plastocyanin found in the poplar and French bean plants.

Another visual technique known as dots enables researchers to look at both the inner and outer structures of proteins at once. In figure K, which illustrates a slice of superoxide dismutase, the sticks represent two flat sheets and the sets of green and blue dots portray atomic surfaces at the sheets' edges. The tight alignment of the dots indicates that the atoms fit together snugly.

In concert, the different techniques for portraying proteins are enabling researchers to understand better the complicated material so central to life.—*LAURA VAN DAM*



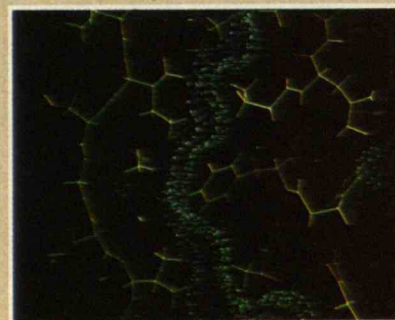
H



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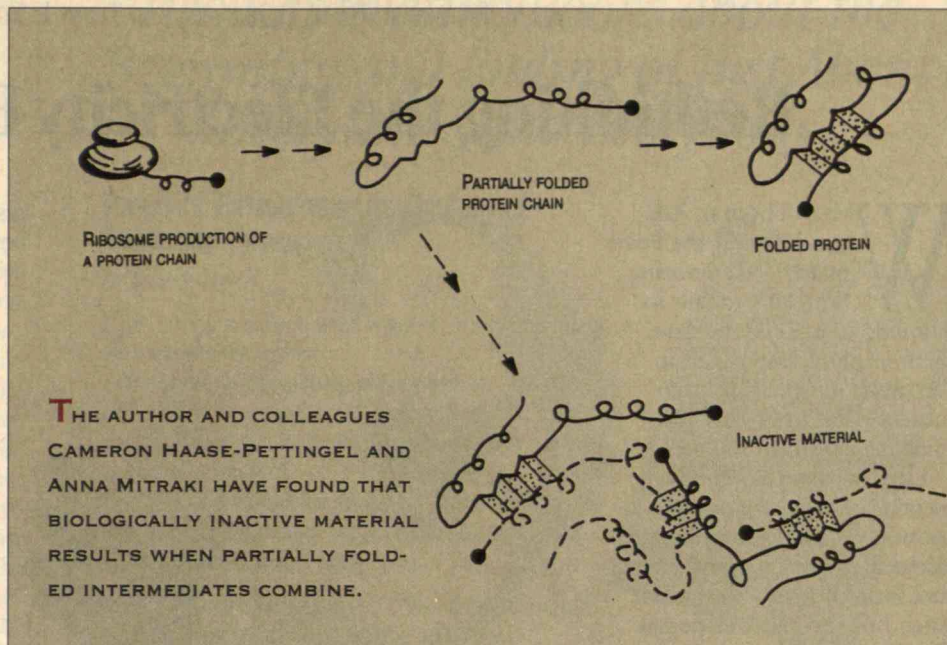
A, B, C, H, K: Jane Richardson, David Richardson; D: Brian Matthews, Jane Richardson, David Richardson; E: Daniel Knighton, Susan Taylor, Janusz Sowadski, Lynn TenEyck, Phil Mercurio; F: H.C. Watson, Progress in Stereochemistry; G: Jacquelyn Fetrow, George Rose; I: Jane Richardson, David Richardson, Larry Bergman; J: David Case, Michael Pique

includes bonds among three pairs of sulfur-containing amino acids. Creighton has identified a folding intermediate that has some of these final bonds. He has also found something he did not expect—a bond among the sulfur-containing amino acids that is not seen in the final protein. This indicates that intermediate states have some unique features that disappear in the final folded protein.

The study of folding intermediates has started to prove useful in reducing the amount of misfolded and hence biologically inactive proteins produced by pharmaceutical firms. My colleagues Cameron Haase-Pettingel and Anna Mitraki and I have found that within cells, it is the folding intermediates rather than the fully folded structures that tend to aggregate. MIT chemical engineering professor Daniel Wang and graduate student Jeff Clelland have used small amounts of inexpensive molecules such as polyethylene glycols, commonly used to purify proteins, to bind to the folding intermediates and keep them from sticking to one another. This suggests a practical way to maximize protein yields.

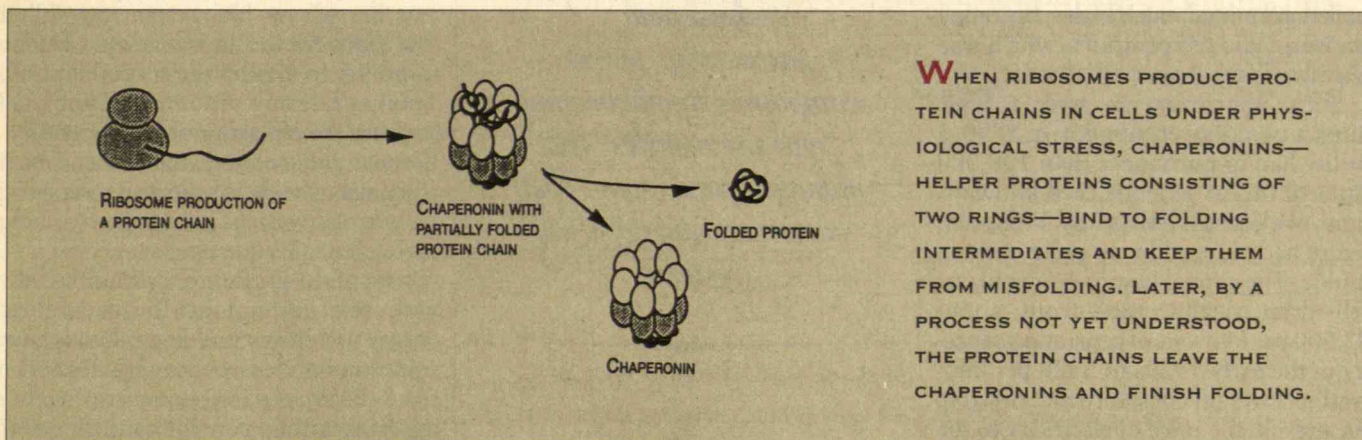
Cell biologists and protein biochemists have also begun to discover that a world of helper proteins, called chaperonins, and other products participate in folding. One class of chaperonins, which are found in all cells, recognize and bind to folding intermediates and keep them from aggregating or otherwise misfolding when cells are under physiological stress. For example, when a person has a fever, the number of chaperonins in his or her cells rises rapidly. Another group of chaperonins keeps certain kinds of protein chains unfolded for an extended period. Many proteins, such as those circulating in blood, must be kept in a nonfolded state until they leave the cell to do their tasks.

While progress on these fronts is promising, efforts to



restrict the flow of basic knowledge threaten the further work needed to fully decipher the protein-folding rules. For example, researchers have been unable to obtain structural information from pharmaceutical firms on proteins involved in the synthesis of HIV, the virus that causes AIDS. There's enormous commercial interest in using that information to develop drugs that can prevent HIV replication.

Under the guise of protecting intellectual property, the National Institutes of Health have recently tried to patent human gene sequences that encode amino-acid sequences. This action could restrain information sharing even more. A group planning to patent will not publish sequence data until a patent has been applied for and granted—a potential several-year delay in the dissemination of critical results. Congress needs to affirm the patent laws as they were formulated by Thomas Jefferson, which excluded the patenting of living organisms or the parts thereof. The revolution in biotechnology was built on free exchange of information and scientific materials. The rewards we should reap from understanding protein folding require a similar commitment. ■



Rethinking the Electricity Business

WHEN Thomas Edison brought the Pearl Street Generating Station on line in Manhattan in 1882, he gave birth to an industry. But in the succeeding century that industry has only half-filled his vision for it.

Edison saw two fundamental functions for an electric utility. One was to generate electrical power by transforming fuel into kilowatt-hours. But since houses and businesses don't have much use for raw kilowatt-hours, Edison believed that utilities should also convert electricity into useful forms, such as mechanical power and lumens of light. His logic was simple. As inventor of both the generating plant and the light bulb, he understood that technology would progressively improve the economies of both generation and conversion. A "lumen-seller" would profit twice from this twin thrust of technology.

The first half of Edison's vision materialized. Central station power production grew enormously from 1882 to 1970, largely the result of improved generating technologies. Pulverized-coal firing equipment raised steam more efficiently than the earlier stokers. Welded (rather than riveted) boilers permitted much higher operating pressures and temperatures, which also translated into greater efficiency.

Such improvements had a huge impact on utility economics. In 1890, a utility had to burn more than 100,000 Btu's of fuel to generate each kilowatt-hour of electrical energy. By 1965, that figure had plunged by an order of magnitude. The capital cost of power plants fell dramatically, too—from about \$2,500 per kilowatt of generating capacity in the early 1920s to \$320 per kilowatt in 1965 (in constant 1982 dollars). As a result, the price of electricity to the



In a new partnership, power companies should become "end-use utilities" that manage—and own—their customers' energy-using systems.

residential sector plummeted 40-fold between 1900 and 1970. For decades, utilities rode a virtuous circle of declining costs, reduced prices, and growing demand—leading again to declining costs and rising profits.

But today's utilities find themselves battling public service commissions for higher rates while contemplating with dread the need to add new generating capacity. Since 1965, the thermal efficiency of the typical generating plant has barely budged. Improving efficiency would require operating the plants at even higher pressures and temperatures—conditions that are prohibitively expensive. Furthermore, the real cost per kilowatt of central station generating plant capacity has risen 5–10-fold since 1965. That's because economies of scale are negated by the diseconomies of complexity: large plants take so long to build, and require such intricate engineering, that construction becomes more difficult and costly. Barring unforeseen dramatic improvements in materials technology, then, we have already realized most of the benefits inherent in Edison's vision of improved generating efficiency.

Custom Energy Management

The future for the power industry lies in its ability to exploit the second half of Thomas Edison's vision: continuing to improve the efficiency of electricity use. Because the existing stock of end-use equipment—such as lights and motors—is extremely wasteful, a huge reservoir of savings remains untapped.

One of the greatest opportunities lies with new technology for managing energy use. Many buildings already use some kind of "energy management system" (EMS) to parcel out energy to the appliances they control. But the vast

The end-use energy utility would differ from the "demand side management" programs that many utilities already practice to improve the economics of power generation. Such programs, which usually aim to reduce a utility's peak load and therefore postpone the need to build new power plants, do not necessarily generate the greatest possible savings for any particular customer. When utilities "give" efficient fluores-

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cent light bulbs to all their residential customers, for instance, the benefits vary greatly, depending on how much time someone spends at home with the lights on. An end-use energy utility, by contrast, would install efficiency measures tailored to produce the greatest energy savings for each individual customer.

Utility Transformation

Efficiency measures will postpone but not eliminate the need for new generating capacity. The best way to add capacity will be by building not a few huge central facilities, as in the past, but rather a large number of small power plants, each located on the customer's premises so that the waste steam can be used for water and space heating. An end-use energy utility would be a logical provider of these "cogeneration" plants. The eco-

nomics of power production would then improve fundamentally.

Today's electric utilities are "rate-base" businesses; costs are added up and charged out to customers on a commodity basis, with price set by a publicly posted regulation called a tariff. The subsidy of one class of customers by another is all but inevitable in this approach to pricing. Tariff setting becomes as much a political as an economic issue, where the needs of industrial development conflict with those of residential customers.

The end-use energy utility cannot operate as a rate-base business—its customers' requirements are too individualized, and competition will not allow it to price its services to subsidize one type of customer at the expense of another. The (EU)2 would charge each customer directly for the

cost of providing its own needs.

End-use energy utilities would feel little of the pressure toward monopolization that has traditionally characterized the power industry. The economies of scale that drove power companies to build central station power plants do not exist for (EU)2s—and without these huge facilities, there is no core around which a monopoly could coalesce. Since an end-use energy utility's investments are customer-specific, franchise territory would have no meaning. As competitive businesses, (EU)2s would not need monopoly regulation—freeing them from the second-guessing and disallowance of costs that plagues today's power generation business.

Any number of enterprises—from telephone companies to computer-service providers to gas companies—could, in theory, jump into the (EU)2 business. But the hundreds of electric-power companies now serving virtually every business establishment in the country have enormous advantages. Unlike other enterprises, companies like Consolidated Edison and Pacific Gas & Electric already have the know-how to invest in, operate, and maintain assets like boilers, chillers, and cogenerators.

By evolving into end-use energy utilities, today's power companies would embrace the second half of Thomas Edison's vision. This transformation would reduce the need for billion-dollar, you-bet-your-company gambles on central-station generating plants: investments in end-use energy systems are made in manageable, million-dollar increments. Electric utilities should hasten to undertake this transformation and earn the benefits. They must realize that economic growth now lies in the management of energy use—not in the generation of electric power. ■

JAMES M. PIEPMEIER, an energy consultant in Evanston, Ill., is a former executive of Georgia Power. DAVID O. JERMAIN is a strategic planning consultant in Portland, Ore., and a former executive of PacifiCorp, the parent company of Pacific Power and Light. TERRY L. EGNOR is president of MicroGrid, a Portland company that develops energy management systems.

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A New Social Contract for Science

HOW well is our society served by the tax money it spends on scientific research? Many observers of American science policy now answer "not very well." A growing number of critics in Washington and elsewhere have begun to question the long sacrosanct link between science and social well-being.

According to the model that has prevailed since World War II, scientists know best what science should be doing. Government should offer financial support for research but not attempt to direct those inquiries toward specific social ends. Of course, this model has been honored as often in the breach as in the observance. Projects with strongly focused goals—military needs, the space program, the war on cancer, and others—have often served to channel scientific activity. These exceptions did not, however, modify the basic rule.

But skeptics are now taking a closer look at the conventional belief that "better science gives you better technology gives you a better way of life." Who can help but notice that some key areas in which science should be most helpful—industrial vitality, education, and health care—are fraught with crisis?

A leading voice in this agonizing reappraisal is Rep. George Brown, chair of the House Committee on Science, Technology and Space. In an essay published last fall, the California Democrat asserted: "Our global leadership in science and technology has not translated into leadership in infant health, life expectancy, rates of literacy, equality of opportunity, productivity of our workers, or efficiency of resource consumption. Neither has it overcome failing education systems, decaying cities, environmental degradation, unaffordable health care, and the largest national debt in history." Those are strong words from a long-time advocate of higher research funding. Such misgivings suggest the need to renegotiate the social contract that binds science to society.

To this rising tide of criticism I would offer some modest proposals. First, our

judgment about the benefit of science to society should itself become a topic for scientific inquiry. Scientists seeking research funds typically declare that their work will produce important social benefits. Let's take that promise as a hypothesis and test it. The net outcome of scientific research ought to be the subject of continuing critical scrutiny. Funds should be set aside—perhaps 5 percent of the research budget—to conduct evaluations of this kind at the outset of each scientific project and periodically thereafter. If the costs of research clearly outweigh its benefits, then the project could be cut back. Even if no such action is taken, the public would gain from the more honest debate that would occur. If the nation decides, for example, to bankroll a multibillion-dollar space station as a first step toward exploring the solar system, OK—but let's strip away inflated claims about the

We should, for example, set up nationally televised forums that enable people to debate what good science does for them and where public funding for science ought to be headed. Let's also appoint some ordinary citizens to the National Science Board, the council that oversees the National Science Foundation, to supplement its current membership of politically influential scientific elders. We could even have two national science boards: one to oversee the quality of research according to professional scientific standards, the other to monitor the benefits that publicly funded science provides to society.

I am not suggesting that science be judged solely on the basis of tangible payoffs. Clearly there are cultural and economic benefits that stem from basic research. I am confident that broader public involvement in science policy



contribution of super-pure crystals to the common good.

Who should be involved in this lively process of testing? Science policy is now crafted by prominent members of the research community, business leaders, analysts in government and private organizations, and our elected representatives. It is time to open up the decision-making process to a much broader spectrum of actors. While still asking technical specialists to judge scientific merit, we should also enlist lay citizens to appraise how publicly funded R&D affects people at the receiving end. (The National Institutes of Health already employs a somewhat similar practice.)

would recognize such good.

But gone is the era in which the value of science to society could be embraced as an item of blind faith. Instead we need to open up the issue for debate in the full light of day. The new contract between science and its public benefactors should regard research as an ongoing social experiment, one that balances scientists' demands for funding with democratic means of setting goals and judging results. ■

*LANGDON WINNER teaches science and technology studies at Rensselaer Polytechnic Institute. He is author of *Democracy in a Technological Society* (Kluwer, 1992).*

Regulations Shouldn't Be Relics

THE guiding principle of regulatory policy is inertia. Because of the ponderous nature of the legislative and regulatory processes and the tug and pull of affected constituencies, environmental standards remain in place despite constant refinement in the scientific, engineering, and economic data underlying them. Sooner or later, the rule becomes a relic. If the government wants to construct a wise set of environmental policies, it will have to address this inherent problem.

It is not difficult to find examples of regulations that swift advances in science or technology have rendered irrelevant or illogical. The Delaney clause of the federal Food, Drugs and Cosmetics Act prohibits the presence in processed food of any substance, no matter how tiny the amount, that causes cancer in laboratory animals. But in the decade that have elapsed since this law went onto the books, the technology for measuring trace substances in food has improved phenomenally. Carcinogenic substances in hitherto unmeasurable traces have been found to be widespread. Thanks to gas chromatographic techniques, for instance, certain pesticides that had been detectable only at parts-per-million levels can now be sensed at parts-per-trillion concentrations. In effect, technology has changed the meaning of zero.

Sometimes new information reveals that regions of the country should be treated differently even though standards are applied uniformly. Present efforts to control ground-level ozone, for example, generally regulate volatile organic compounds rather than regulating emissions of oxides of nitrogen (NO_x), even though both are chemical precursors to ozone. But a recent study by the National Academies of Sciences and Engineering concluded, based on a new understanding of ozone formation, that in some areas of the country control of NO_x would be more effective. By largely ignoring these regional variations, the study concluded, EPA's regulatory strategy over the past two decades has been seriously misdirected.



*Environmental rule making
needs to reflect swift advances
in science and technology.*

Rapid changes in scientific understanding were strikingly evident in early studies of stratospheric ozone. In the early 1970s, the ozone layer was thought to be threatened with depletion by NO_x emissions from supersonic aircraft then under development in the United States, England, and France. U.S. legislation called for biennial assessments of the scientific knowledge of how nitrogen and chlorine affect the ozone layer.

The results from these studies proved eye-opening to scientists as well as legislators: each estimate of the effects of nitrogen tended to be more encouraging than the last. The United States did not attempt to base any regulations on these swiftly shifting findings, but only because economic concerns forced the cancellation of its supersonic transport program. It was only with the discovery of the Antarctic stratospheric ozone hole, and the conclusion that it was caused largely by the emission of chlorofluorocarbons (CFCs), that domestic

and international regulatory action was taken to phase out CFC production.

Some environmental legislation has indeed recognized the dynamic nature of the technical basis for regulation by authorizing R&D to improve understanding of the causes of problems. Some laws also offer incentives to develop new, more cost-effective technology. Infrequently, legislation explicitly includes schedules for reconsidering specific regulatory decisions. The Clean Air Act, for example, mandates reviews every five years of the National Ambient Air Quality Standards.

But it is not enough simply to conduct research. During the 1980s, the United States spent hundreds of millions of dollars studying the causes and consequences of acid rain. But the decade-long National Acid Precitation Assessment Program (NAPAP) focused too heavily on questions of scholarly rather than policymaking interest. NAPAP was reportedly unable to provide timely advice on the pollution controls that would be required by Congress's decision to lower total sulfur-dioxide emissions by 10 million tons per year.

There are encouraging signs that the issue of outdated regulation is being confronted. The new administrator of the Environmental Protection Agency, Carol Browner, wants to reconsider the zero-tolerance Delaney clause. The EPA is also rethinking its national strategy on ambient ozone control in light of the recent studies on regional variations.

Ultimately, all environmental legislation should build in a mechanism for updating regulations based on the periodic review of the underlying science and engineering by organizations who have little stake in the outcome. We can never expect, and may never even want, the regulatory tortoise to match the speed of the technology hare. But we can hope that it moves fast enough to keep the hare in sight. ■

ROBERT M. WHITE is president of the National Academy of Engineering. He was awarded the 1992 Tyler Prize for environmental achievement by the University of Southern California.



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BY ROBERT J. CRAWFORD

A NEW brand of activist has emerged during the last 20 years: the biozealot. Expert at peddling fear and impassioned accusation, biozealots grab media attention by disrupting animal experiments, heckling government science committees, and sometimes threatening terrorist retaliation for environmental "crimes" of their choosing. Biotechnology, the manipulation of the chemical building blocks of life, is to them the ultimate tool of hubris, perhaps the final link in human domination and destruction of nature.

While radical activists in general may blaze trails to necessary social change, biozealots are actually falling further and further behind today's dialogue on biopolitics. A larger, progressive community has begun to seek solutions to environmental and biological resource crises. Scientists, corporate leaders, and government officials are actively experimenting with sustainable agriculture, the preservation of biodiversity, and environmentally friendly industry.

Unfortunately, Michael Fox's book *Superpigs and Wondercorn*, for all its rhetorical nods to "appropriate" applications of biotechnology, displays the same alienation, intolerance, and pseudo-innocence as the author's fellow biozealot Jeremy Rifkin. As vice-president of the Humane Society of the United States, Fox has long opposed experiments in biotechnology. Fox complains: "Jeremy Rifkin . . . and I challenged the National Institutes of Health to temporarily suspend government-funded transgenic animal research until the ethics and consequences . . . had been fully explored and publicly aired.

We met with united opposition."

And no wonder. Fox's sweeping condemnations, visions of environmental Armageddon, and calls for grass-roots action—often repeated verbatim from one chapter to the next—numb the reader even to his legitimate concerns. Research in biotechnology, he demands, must be stopped until it can be proven *totally* safe and beneficial. Moreover, like any zealot, Fox attacks the integrity of anyone who dares to disagree.

For example, without ever clearly defining it, Fox repeatedly condemns the "petrochemical-pharmaceutical industrial complex," or "PPIC," for conspiring to monopolize the world's genetic resources, a kind of modern-day technocolonialism. He lumps together scientists, businesspeople, and government bureaucrats as arrogant elitists, a "biotechnocracy" whose "mechanistic" ideology allows them to separate their research from all ethical or moral scruples.

If unchecked, claims Fox, this cabal could impose its "agricidal paradigm" on everyone, somehow forcing us to buy its dangerous, though inferior, products. Nonetheless, apparently contradicting his earlier thesis that PPIC is omnipotent, he concludes: "Advances in animal agriculture that are not integrated with a humane and sustainable agricultural paradigm that is socially just and 'environmentally friendly' will be opposed by an increasingly vociferous, influential, and informed public."

To back his assertions, Fox offers little or no proof, only the occasional isolated example. This type of synecdoche is misleading, but it may also illustrate a more fundamental problem: Fox's isolation from, or ignorance of, the "humane and sustainable" biotechnology that is already emerging.

Many pharmaceutical manufacturers, for example, have become alarmed by the destruction of tropical rainforests. To preserve this priceless reservoir of natural substances, they are pouring resources into several developing countries. In 1991, Merck & Co. invested over \$1 million to establish the National Institute of Biodiversity in Costa Rica, a

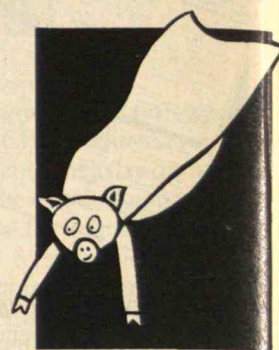
base for "chemical prospecting" that will double as a nature preserve. As an active partner in the initiative, the Costa Rican government will receive royalties from any natural-drug products developed from this research.

In a similar effort, Shaman Pharmaceuticals, a start-up company in San Carlos, Calif., has set up a nonprofit organization, the Healing Forest Conservancy. With the cooperation of ethnobotanists and rainforest activists, the conservancy will pay native healers for their knowledge; its goal is to preserve their cultures and local economies.

To be sure, the behavior of these companies deserves scrutiny, but their contributions to developing countries could represent a new synergy of enlightened profit making and the protection of nature. Their efforts, as well as those of many concerned scientists and politicians, have helped push the preservation of biodiversity to the top of the environmental agenda.

But these endeavors are not the only disproof of Fox's seamless biotechnocracy. The rapid increase of biotechnology start-up companies has decentralized the biomedical industry, opening up new avenues for financing and injecting younger researchers into a once stodgy and conservative field.

Contrary to Fox's accusations, many biotechnology companies are deeply concerned about the environmental impact of their products, if only to avoid a public backlash that could cripple the entire industry. They are keenly aware that ecology is an infant science and that the consequences of large-scale environmental releases could be devastating. To strengthen the Coordinated Framework—a patchwork of biotech regulations and guidelines administered through five separate federal agencies—biotech firms are cooperating closely with officials and public interest groups. Indeed, many firms prefer stringent



safety guidelines, both as protection from potential legal liabilities and as a hedge against abrupt regulatory clampdowns.

This is not to imply, of course, that all the problems of this new industry have been solved. Bio-engineered pesticides may perpetuate or even increase agriculture's dependence on chemicals. And ethical and moral dilemmas are legion, ranging from eugenics experiments—the selective breeding and genetic engineering of human beings to attain “superior” abilities and disease immunities—to “genetic culling” of high-risk clients by insurance companies. But to ignore the existence of open and wide-ranging discussion of these issues, as Fox has apparently done, is to deny the vitality and good faith of many government-sponsored initiatives. Under the auspices of the National Institutes of Health, for example, an ethics committee is debating the implications of the Human Genome Project, the international effort to locate all human genes; this is an open forum that encourages public participation. Proposed changes in biotech regulatory policy must be published in the Federal Register, allowing interested groups to critique them and offer alternatives and suggestions.

Fox's book is not without value. Attempting to develop an ethical framework for the genetic engineering of farm animals, Fox argues convincingly that livestock should not be turned into living pharmaceutical factories or feed-efficient giants. The insertion of foreign genes can greatly increase animals' suffering. Transgenic pigs, for example, can produce a less expensive, beeflike meat, but they are also “arthritic, lethargic, and [have] defective vision arising from abnormal skull growth.” Because bacteria cannot suffer, Fox believes, they would make better bioreactors than would “pharm” animals.

Nonetheless, by insisting that medical research has absolutely nothing to gain from animal research, Fox once again betrays his cause. Rather than seeking common ground with his critics, he merely preaches to the biozealot choir.

In the end, Fox's book is a com-

pendium of worst-case biotech scenarios. AIDS mice, he speculates, might somehow mutate the virus they carry, rendering it transmissible via saliva or urine; the “ice minus” bacterium, designed to delay crop freezing, might find its way into the atmosphere, where it “could conceivably . . . inhibit rainfall and cause drought.” This is useful information, but virtually all of it has been heard before.

There are better critics and analysts of the biotechnology industry, most notably Jack Doyle (*Altered Harvest*) and Walter Truett Anderson (*To Govern Evolution*). Their science is more accurate, their treatment of ideas far more systematic and evenhanded. Perhaps most important, they understand that differing perspectives can be incorporated into an emerging consensus on how—and not whether—we should nurture and manage the world's precious biological resources. ■

ROBERT J. CRAWFORD, a former subcommittee manager in the Office of Recombinant DNA Activities at the National Institutes of Health, is now assistant director of the Office for Sponsored Research at Harvard University.

BOOKS

BEDTIME IS RELATIVE

Einstein's Dreams
by Alan Lightman
Pantheon Books, \$17

BY DAVID BRITTAN

A PHYSICIST and a poet meet at a café on the Kramgasse in Bern, Switzerland and contemplate the nature of time. “Time is unyielding, predetermined,” says the physicist.

“Yet,” the poet counters, “it squirms and wriggles like a bluefish in a bay.”

“What if time passes more slowly for people in motion?” says the physicist. “To gain time, everyone must travel at high velocity.”

“Or,” says the poet, “suppose that time is not a quantity but a quality, like the luminescence of the night above the trees just when a rising moon has touched the treeline. It exists, but it cannot be measured.”

As their musings grow wilder and wilder, it becomes apparent that the physicist and the poet are in fact the same person. They are Alan Lightman, arguing with himself.

Throughout his life, the Memphis-born physicist and poet has struggled to balance his two selves, going so far as to divide his time at MIT between teaching physics and running the Program in Writing and Humanistic Studies. *Einstein's Dreams*, his best-selling first novel, brings the two Alan Lightmans together for 30 meditations on time. The setting is Bern—where the young Einstein worked as a patent examiner—in the months leading to the completion of the special theory of relativity in 1905. Every few nights, Einstein dreams about time. In each dream, the citizens of Bern go about their lives as shopkeepers or lawyers, lovers or parents, sippers of coffee or writers of letters. Yet in each dream, they have had to accommodate some grave alteration in the way time works.

In a world where time passes slower the farther one gets from the center of the earth, people take to the high ground to preserve their youth. In a world without memory, notebooks are indispensable. Where time is a sense, like sight or taste, some see life whizzing by as in a Chaplin film, others feel it pass with the slow progress of clouds. Where time is a visible dimension, people have the option of sticking close to a comfortable moment or rushing blindly into the future.

One of the dreams hands Einstein the vision of time he will incorporate into his special theory, but it is camouflaged among the other visions, just as it is camouflaged in this review. “An insider joke in the book is that the true theory of rel-



ativity is at least as fanciful as all the other dreams," says Lightman in his office at MIT. "Twentieth-century physics has gone into such incredible realms that our new view of nature appears fantastic and unbelievable."

Through *Einstein's Dreams*, the human mind is revealed to be no less fantastic and unbelievable. At first glance, the dreams are bizarre distortions of time as we know it. But on closer inspection, they are time as we know it.

Pathologies of Time

Physicists see time as a straightforward affair—it flows in one direction, from past to future. "The second law of thermodynamics says that systems become more and more disordered in time," Lightman explains patiently. Why not the reverse? Probability, he says. Odds are great that a pendulum will gradually cease to swing as its energy is absorbed by the surrounding air molecules. Odds are slim that the air molecules will spontaneously organize themselves to nudge a still pendulum into motion. Time as nature offers it to us is simple.

But what physicists know—or think they know—about time is almost irrelevant to our actual experience of it. The past, even though in the physical sense it has vanished irretrievably, stays alive in our memories. The present, which has no special cosmological significance, is the conduit for our senses and the stage for our actions. The unknowable future is the foundation of all hope, will, and sense of progress. Time is life, as the saying goes.

Time is also the subject of endless refractions as it filters through the human mind. Here the straight line of the physicist can become a tangle of detours and U-turns that render past, present, and future indistinguishable. In this regard, *Einstein's Dreams* is a laboratory for studying pathologies of time. Its instruments are the metaphors and insights of the poet.

In a dream where "imagining the future is no more possible than seeing colors beyond violet," people are para-

lyzed. "They lie in their beds through the day, wide awake but afraid to put on their clothes. They drink coffee and look at photographs," Lightman writes, perfectly describing the narrowed horizons of the depressive. In fact, who hasn't been so overwhelmed by the pressures of the moment that the future seems to evaporate?

An obsession with the future can be just as debilitating. In one dream, time is a river with back eddies that sometimes sweep people into the past. A woman displaced in this way crouches in the shadows at no. 19 Kramgasse, frozen at the thought of altering the future.

She huddles in a corner, then quickly creeps across the street and cowers in another darkened spot, at no. 22. She is terrified that she will kick up dust, just as a Peter Klausen is making his way to the apothecary on Spitalgasse this afternoon of 16 April 1905. Klausen is something of a dandy and hates to have his clothes sullied. If dust messes his clothes, he will stop and painstakingly brush them off, regardless of waiting appointments. If Klausen is sufficiently delayed, he may not buy the ointment for his wife, who has been complaining of leg aches for weeks. In that case, Klausen's wife, in a bad humor, may decide not to make the trip to Lake Geneva. And if she does not go to Lake Geneva on 23 June 1905, she will not meet a Catherine d'Épinay walking on the jetty of the east shore and will not introduce Mlle. d'Épinay to her son Richard. In turn, Richard and Catherine will not marry on 17 December 1908, will not give birth to Friedrich on 8 July 1912. Friedrich Klausen will not be father to Hans Klausen on 22 August 1938, and without Hans Klausen the European Union of 1979 will never occur.

This sort of precognition is not exactly universal, but the fear of setting off a chain of ever more significant events may well be. Lightman finds this fear dehumanizing: "If you feel you have to tiptoe around everywhere and not disturb anything, you can't participate in the world," he says.

The same holds true in a world where time is "sticky," trapping people in some moment of their lives from which they can never free themselves. Here a man

speaks only of his school days, years after his friends have moved on to successful careers. Another is doomed to relive a dinner long ago at which he failed to tell his father he loved him. Elsewhere, a woman gazes at an old photo of her son in the pink of his youth.

She writes to him at a long-defunct address, imagines the happy letters back. When her son knocks at the door, she does not answer. When her son, with his puffy face and glassy eyes, calls up to her window for money, she does not hear him. When her son, with his stumbling walk, leaves notes for her, begging to see her, she throws out the notes unopened. When her son stands in the night outside her house, she goes to bed early. In the morning, she looks at his photograph, writes adoring letters to a long-defunct address.

The tragedy of this existence, Lightman concludes, is that "each person who gets stuck in time gets stuck alone."

It would be easy to dismiss the inhabitants of Lightman's dreams with mutterings of "there but for the grace of God." But viewing these familiar neurotics as specimens under glass, we should not be surprised if we sometimes glimpse our own faces reflected back.

Decisions, Decisions

The dreams do more than just catalog our neuroses. They also underscore some fundamental conflicts in the human relationship to time: the unpredictability of people versus the predictability of time, the fluidity of minds and bodies versus the rigidity of clocks, and, above all, the agony of decisions. If time were three-dimensional—having a vertical, a horizontal, and a longitudinal direction like space—decisions would lose much of their momentousness. You could, like a character in one of the dreams, travel down each axis and see the consequences of a decision played out three different ways: a happy marriage, an unhappy marriage, a marriage to someone else. But because time is one-dimensional, giving us but a single shot, we are forever gauging the possible results of our actions.

Lightman hates this sort of predica-

ment. "I don't like getting in situations where no matter what you do, you're trying to calculate its effect—how people will react, whether it will have a long-term payoff for you," he says. "Even though I myself have a lot of difficulty being spontaneous, I value it. And I value sincerity."

His answer to a world without spontaneity and sincerity is a world without cause and effect—where cause sometimes precedes effect but often succeeds it. In this world, the cosmos is irrational and scientists find themselves without meaningful employment. Yet clerks speak their minds to their bosses without fear of retribution, and people are loved for themselves rather than for the rewards they can bestow. Lightman writes: "It is a world in which every word spoken speaks just to that moment, every glance given has only one meaning, each touch has no past or no future, each kiss is a kiss of immediacy." If *Einstein's Dreams* has a single clear message—and Lightman swears it doesn't—then this is it: people are happiest living in the moment.

What does living in the moment have to do with Einstein? Nothing, and yet everything. Einstein is a bit player in Lightman's opus; he and his theory of relativity are the frame, an excuse to fantasize about time. But Einstein was also the inspiration for the book. "I was captivated," says Lightman, "by the idea of Einstein dreaming, which expresses a lot of the dialectic in the book: 'Einstein' on the one side—this rational being who deals quantitatively with the laws of nature—and then 'dreams' on the other side, which has an ambiguous, poetic, hazy feeling to it. The antithesis of these two ideas—these two words—seemed to spawn all sorts of rich possibilities."

Einstein and dreams. Physics and poetry. "The title descended on me from I don't know where, though I was certainly thanking the muses when it came," says Lightman, perhaps unaware that it refers to himself. ■

DAVID BRITTAN, a senior editor of *Technology Review*, lives contentedly in the remote past.

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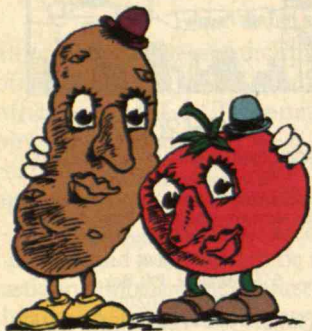
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Notes



You Say Tomato, They Say Potato

Even though Carl Linnaeus proposed in 1753 that tomatoes belonged in the same genus as potatoes, most taxonomists and botanists have maintained that the plant deserves its own separate status. But a new study suggests that Linnaeus was right all along. DNA samples from more than 25 species indicate that potatoes are more similar to tomatoes than they are to other members of their own genus, according to Robert Jansen, a molecular botanist at the University of Texas.

Jansen and his colleagues argue in the May issue of the *American Journal of Botany* that the scientific community should move the tomato from its own genus *Lycopersicon* into the potato genus *Solanum*. The researchers propose that the tomato change its name from *Lycopersicon esculentum* (which translates roughly as "edible wolf peach," since the tomato was originally thought to be suitable only for wolves) to the name Linnaeus originally suggested, *Solanum lycopersicum* (which means "sleep-inducing wolf peach," since many members of the potato genus are poisonous).

According to accepted practice in the field, the name change will be official when the peer-reviewed article is published, says Jansen, though researchers will have the option of using either name. But while

the scientific evidence is hard to refute, he maintains, many will resist the change for practical and philosophical reasons. Some scientists will point to the enormous number of revisions that would be required in the botanical literature, he says, while others will contend that the tomato should retain separate status because of its economic importance. Thus, the tomato may go by two scientific names, Jansen says, a common occurrence for a number of obscure plants but a first for a major crop.

"More important than the name change," says Gregory Anderson, a botanist at the University of Connecticut and co-author of the article, "is that researchers will now be more curious and more confident about looking at the potato family for breeding and genetic-engineering material to help develop more productive and disease-resistant tomatoes."



The Day the Earth No Longer Stood Still

Did you ever wish there were just a few more hours in the day? Well, according to NASA researchers, if the earth hadn't been set spinning by a chance collision with a planet-sized object some 4 billion years ago,

our days might now be more than 200 hours long. "From the present rate of spin, we believe something about the size of Mars—one-tenth the earth's size—struck the planet during its formation and set it spinning, just as we would spin a globe by pushing it with our fingers," says Luke Dones, an astrophysicist at NASA Ames Research Laboratory. "If earth had been hit only by many small objects, like the asteroids we see today, it would have begun spinning very slowly, since the angles of impact would have canceled each other out."

That the earth spins eastward is also a matter of chance. It's equally likely that the planet could have been hit from any angle and thus spun in another direction, Dones says. The fact that Venus spins "backward" and Uranus spins on its side, he believes, further supports the giant impact theory.

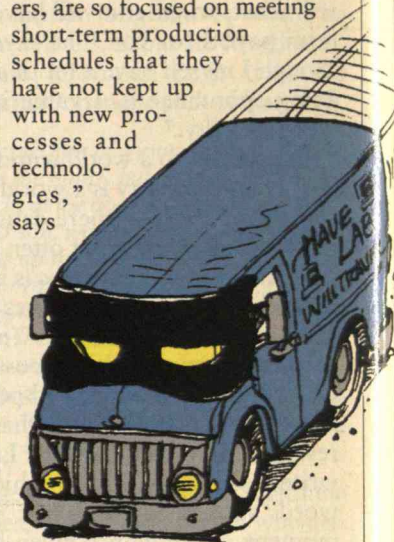
Such a blow could also explain the long-standing mystery of the moon's origin. "The collision that gave earth its spin could also have thrown considerable debris into orbit," Dones says, "which could have then condensed to form the moon."

Who Was That Masked Van?

The Lone Ranger was famous for riding into town, helping folks in distress, and then, with no payment except gratitude, galloping off into the sunset. Now a high-tech mobile laboratory from the Institute for Competitive Manufacturing at the University of Illinois is attempting to emulate such altruism by cantering to the doorways of small, troubled companies and offering free technical support.

Teams of engineering students and faculty advisers have thus far responded to calls for help from some 40 companies

notified of the program in Illinois and surrounding states. "These firms, like so many others, are so focused on meeting short-term production schedules that they have not kept up with new processes and technologies," says



institute director John Nowak. "And because they are so small, they are not able to afford high-priced consultants or expensive employee-training programs."

The students focus first on streamlining processes. For example, students were able to save Coradco, a small manufacturing firm in Rantouls, Ill., some \$400,000 a year in parts as well as set-up and assembly time by reducing the number of components from 15 to 5 on two product lines. The students then try to make use of the van's computers, machine tools, and data-acquisition equipment to demonstrate the advantages of computer-integrated manufacturing.

Nowak asserts that the program, which is funded by the Illinois Department of Commerce and the Illinois Board of Higher Education, benefits all participants: "Companies are introduced to new practices at no cost, students are exposed to unstructured problem solving, and the faculty gets immediate feedback on the usefulness of new manufacturing algorithms and techniques."

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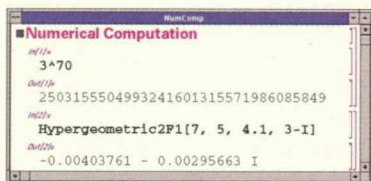
"The importance of the program cannot be overlooked"

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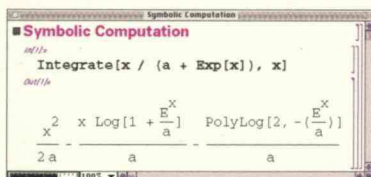
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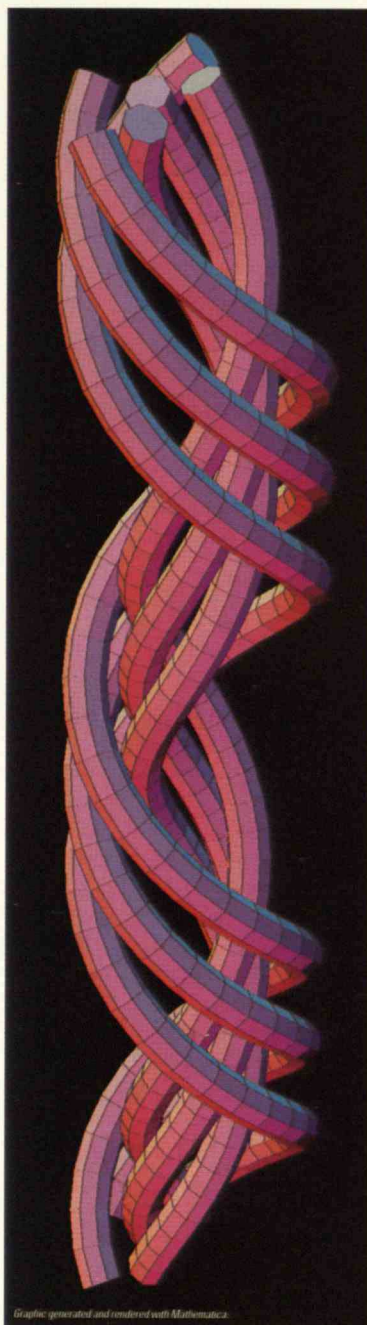


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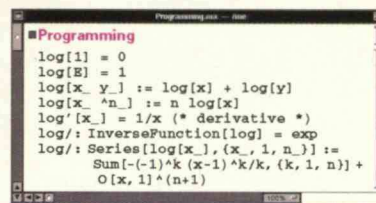


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